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RUSSIA

ROUTE ZONE A

MURMAN RAILWAY

AND

KOLA PENINSULA



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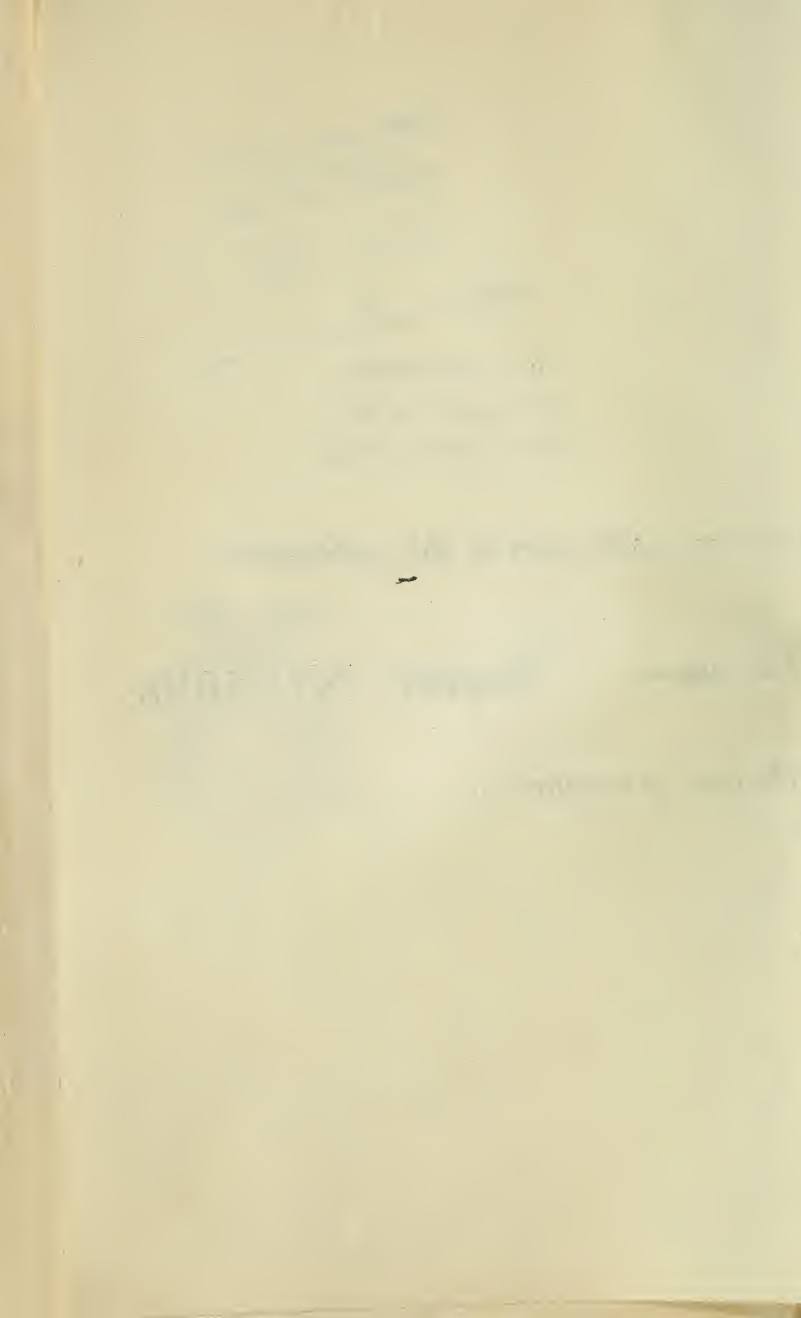
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RUSSIA

Route Zone A

MURMAN RAILWAY AND KOLA PENINSULA

INFORMATION AND ROUTE NOTES

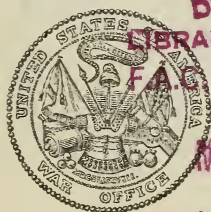
MURMANSK TO PETROGRAD

MILITARY MONOGRAPH SUBSECTION M. I. 2

MILITARY INTELLIGENCE DIVISION

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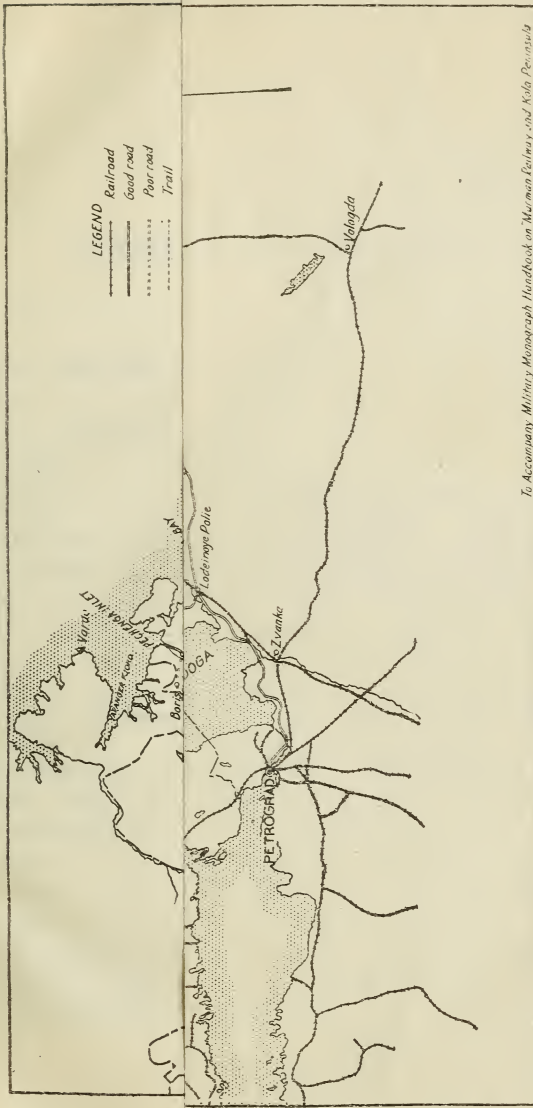
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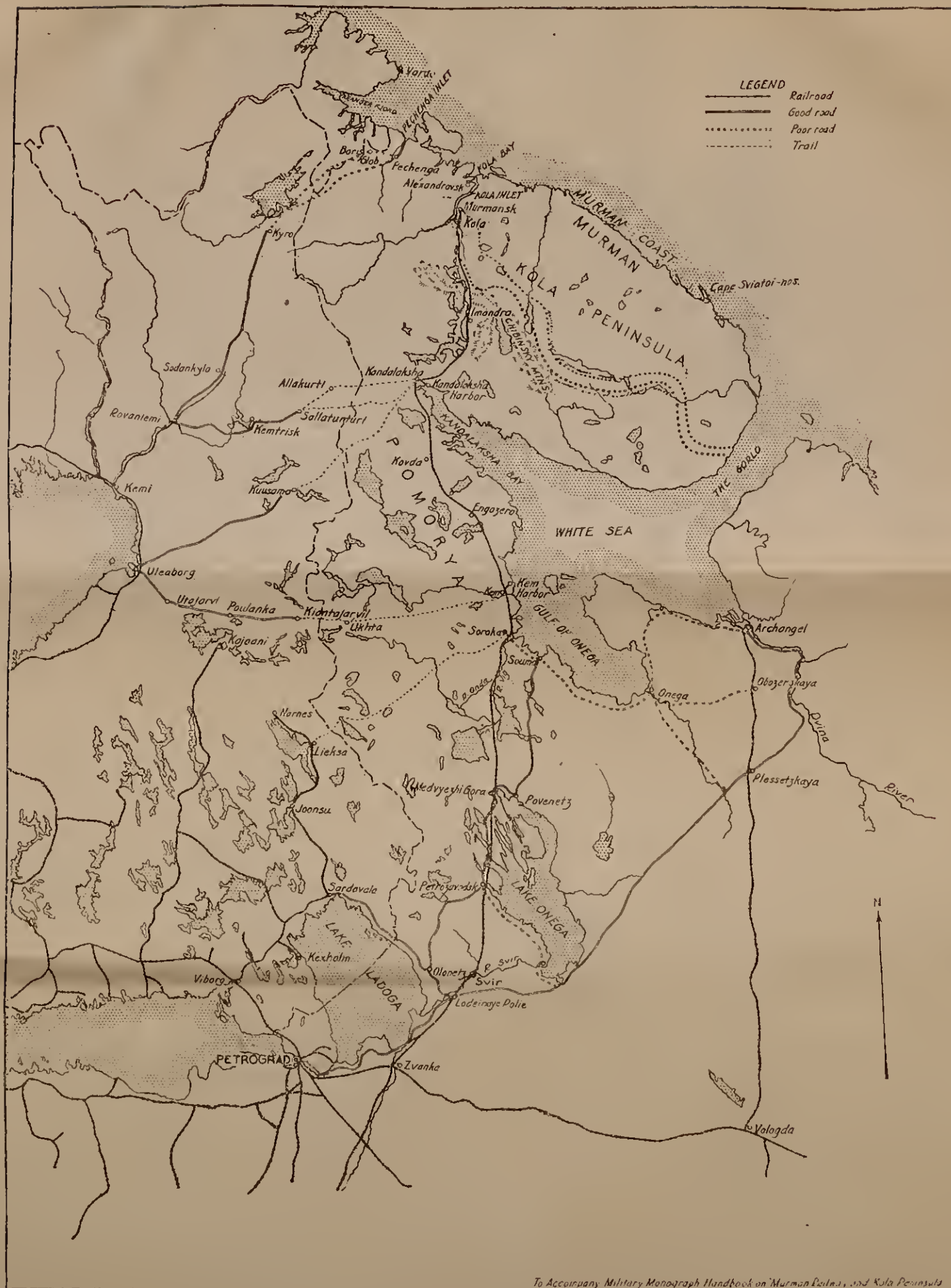


To Accompany Military Monograph Handbook on Murman Railway and Kola Peninsula
1915.

MIL. MON. SUB-SEC. M. 1.2 M. I. D.

NORTHWESTERN RUSSIA

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To Accompany Military Monograph Handbook on Murman Peninsula and Kola Peninsula

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MIL. MON. SUB-SEC. M. 1.2 M. I. D.



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INTRODUCTION.

VALUE OF NORTHERN ROUTES.

If military operations are to be carried on in Russia it would be desirable to have access from all sides. In case the Baltic and Black Sea entrances should be closed, it would be necessary to choose between the northern routes via Murmansk and Archangel and the eastern routes via Siberia.

On the east the distance from Seattle to Vladivostok is 3,908 statute miles, and from Vladivostok to Moscow 5,391, or a total journey by sea and land of 9,299 miles. This is also a fair average figure for the distances involved in the various alternative routes from the east.

From the north the route is by sea from Halifax to Murmansk, 3,000 miles, and thence by rail to Moscow, 1,215 miles, or a total of 4,215 miles only. The alternative route, via Archangel is 330 miles longer by water and 510 miles shorter by rail. Owing to ice in the White Sea, however, the port of Archangel is closed to navigation several months in the year. As this line is of better construction and has more ample terminal facilities than the Murman route, it should be used in summer. The Murman route, however, is the only passage into Russia from the north available at all seasons, and the port of Murmansk the only door which is never closed.

The parallel railway lines running south from Murmansk and Archangel, respectively, both intersect the east and west line from Petrograd to Siberia, the former at Zvanka and the latter at Vologda. Either of these northern routes, which supplement one another, is over 5,000 miles shorter than those from

the Pacific. If military operations are carried on in northern Russia, the importance of these lines, directed toward the flank of any armies operating from the east, is apparent. (A separate handbook entitled "Southern Routes from Archangel" describes the Archangel-Vologda and Archangel-Dvina River routes.)

LOCATION.

KOLA PENINSULA.—From the extreme northern point of North Cape two peninsulas, of unequal size, extend toward the southwest and southeast, respectively. The former is the Scandinavian and the latter the Kola. The Kola Peninsula, embracing a territory as large as England and Wales, is bordered by the Arctic Ocean on the north and the White Sea on the east and south.

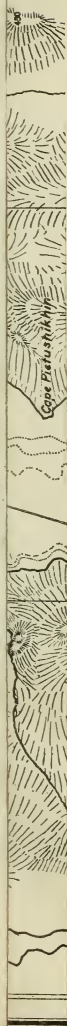
MURMAN.—The northern coast of the Kola Peninsula, from the Norwegian boundary on the extreme northwest to Cape Svatoi Nos on the southeast, is known as the Murman (Norman) coast, and this coast, with its hinterland, is called Murman. The term, however, is somewhat loosely used, and seems to be occasionally applied to the entire Kola Peninsula. Under the latest administrative division of Russia, August, 1918, Murman, as a political subdivision, includes both the Kola Peninsula and the Pomorya.

POMORYA.—This is the coast country west of the White Sea, as far south as Kem. The name means "along the sea."

KARELIA.—This is the country west of the White Sea from Kem south and around its southern shores. The entire western coast, both north and south of Kem, is also sometimes called the Karelian coast.

KOLA BAY AND INLET.—In the far western part of the Murman coast lies Kola Bay, opening into the Arctic on the north and narrowing toward the south into the long Kola Inlet, which averages from $1\frac{1}{2}$ to $3\frac{1}{2}$ miles in width and extends about 46 miles from the ocean. Owing to the Gulf Stream, a branch

SOUTHERN PORTION OF THE KOLA INLET



1907-11

Scale



SOUTHERN PORTION OF THE KOLA INLET





of which flows along the coast, both bay and inlet are never so solidly frozen as to prevent navigation.

MURMANSK.—Murmansk, Russia's only ice-free port in the north, dates only from 1916. It is located on the eastern shore of Kola Inlet, about 30 miles south of the Arctic Ocean. It is the northern terminus of the Murman Railway. From this port the line runs south about 820 miles to Zvanka, where it joins the east and west line from Siberia to Petrograd.

HISTORY.

It is not definitely known at what time this great region came under the rule of the Slavs of Novgorod, but the village of Kola is mentioned in Russian annals as early as 1264. Kandalaksha and a few other settlements were founded in the fifteenth century. Christianity was adopted by the native population about 1533 and a monastery established at Pechenga. The earliest merchants on the peninsula were Russians from Novgorod, and the trade soon became important; but Peter the Great was the first ruler to pay serious attention to the possibilities of the region. His attention, however, became diverted to the west, and this part of his dominions entered upon a long period of neglect and decline. It is only in very recent years that its importance from several standpoints has once more become recognized.

TERRAIN.

A detailed description of the country adjacent to the railroad is given later in the route notes. The more northern part of the adjoining country constitutes a vast wilderness almost devoid of roads and settlements and until recently but little known. It is a wild and desolate land abounding in swamps, lakes, and streams, with bare rocks and sparse vegetation. Farther south this Arctic vegetation gives place to spruce and pine forests, which in the White Sea coast region are sometimes almost impenetrable for tens of miles. On the western part of the Mur-

man coast, which is somewhat warmer than the eastern, pine and spruce begin about 20 to 25 miles south of the Arctic shore; in the eastern section some 60 to 70 miles. Throughout the country the banks of streams and lakes are covered with birch and willow, while the northern berries—snow, moor, and crowberry—are fairly abundant everywhere. (See illustrations 1-4.)

The country generally is hilly, and at the same time swampy, swamps and peat bogs being found well up on the hillsides. The hills around Kola Bay and Inlet rise 300 or 400 feet, while most of those in the northern part of the country are lower, attaining but 100 or 200. Somewhat west of Kola, however, the higher hills of northern Scandinavia extend southeastward. Near the center of the Kola Peninsula they form two rugged highlands almost circular in form. The larger of these, known as Umptek Khioinskiya, about 25 miles in diameter and 4,000 feet high, rises directly from the line of the railroad, on the east, and dominates the road for 20 to 25 miles, centering at the station of Imandra. The smaller highland, known as Luyavvurt, is 14 miles in diameter and 3,600 feet high. It lies east of the larger one, from which it is separated by a lake. These highlands form part of the range of the Chibinsky Mountains, which extend from the northwest and which are crossed by the railroad in the Lake Imandra section. (See illustrations 5-6.) From the central watershed formed by these mountains the rivers of the peninsula flow south, east, and north. Of these the largest is the Ponoï, flowing eastward. (See illustration 7.) Toward the head of Kandalaska Bay, at which is situated the important station of Kandalaksha, the Finnish mountains, which stretch westward from Finland, diminish into foothills of a few hundred feet elevation. Following the railroad south along the western White Sea coast region, known as the Pomorya, we find stony soil in the north and near the shore, while inland the surface consists chiefly of turf and more rarely of sand. Deep bogs and marshes abound, as do long stretches covered with scattered glacial boulders. Everywhere

lakes of all sizes are linked into chains by rivers which flow into the White Sea. As waterfalls and rapids are frequent, however, these waterways are not navigable for long stretches.

FAUNA.

The fauna resembles that of other high latitudes. It consists mainly of such animals as foxes, otters, martens, bear, elk, deer, and hares, while the birds include partridges, capercaillie, grouse, black cock, loons, and eiders. Reindeer are tamed and used in the transportation of both mail and passengers. There are few cattle or horses. Fish of many kinds abound both in the seas and inland waters. Mosquitoes are a serious pest throughout the country. (See "Southern Routes from Archangel.")

CLIMATE.

A. ATLANTIC INFLUENCES.—The relatively high temperature of the Atlantic Ocean, due to the Gulf Stream and the Atlantic Drift, is noticeable on the Murman coast as well as farther west. The north and northwest winds blowing over this relatively warm water make the climate not only much more temperate than that of the interior, but even much milder than that of Petrograd, nearly 1,000 miles farther south.

B. SEASONS.—In general, winter lasts from about the middle of November until the middle of April; spring, which is the rainy season, from mid-April to mid-July; summer until the middle of September; and autumn until the middle of November. In the Pomorya (western White Sea coast region) the first snow falls usually by early October, and the ice melts on the rivers early in June. There are violent snowstorms in winter, the snow sometimes drifting in forests and hollows to a depth of 15 to 20 feet. In Alexandrovsk houses are often covered to the roof overnight.

C. PRECIPITATION.—The maximum mean annual precipitation in northwestern Europe is in northern Norway (69

inches). Thence south, southeast, and east it decreases rapidly (Viborg, 26 inches; Moscow, 22; Vologda, 20; Archangel, 16). The center of this area of decreased precipitation is the Kola Peninsula (Kem, 14; Kola, 7). The coast naturally here shows a greater precipitation than the interior, Kola recording the lowest figures observed. The following table gives the figures in inches for that point for the 11 years 1878 to 1888, inclusive. It should be noted that this table gives the figures for rain only, as, owing to the violent winds which usually accompany the snow in winter and other causes, it was found impossible to determine the figures for the latter. The figures for the winter months are therefore too low.

Average rainfall at Kola, 1878-1888.

Month.	Mean.	Mean maximum.	Mean minimum.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	0.26	0.61	0.04
February.....	.12	.52	.00
March.....	.23	.57	.05
April.....	.36	.78	.00
May.....	.49	1.07	.11
June.....	.78	1.65	.20
July.....	1.28	2.04	.44
August.....	1.16	2.46	.32
September.....	.96	1.50	.35
October.....	.75	1.28	.12
November.....	.48	1.02	.02
December.....	.30	.65	.05
Total.....	7.17	14.15	1.70

D. ARCTIC NIGHT.—Because of the high latitude the polar night lasts from November 26 to January 22, but there are frequent displays of the aurora borealis, so brilliant that it is possible to take photographs by their light. In summer, daylight continues throughout the 24 hours, and in the coast region the sun does not descend below the horizon at all during June and a part of July.

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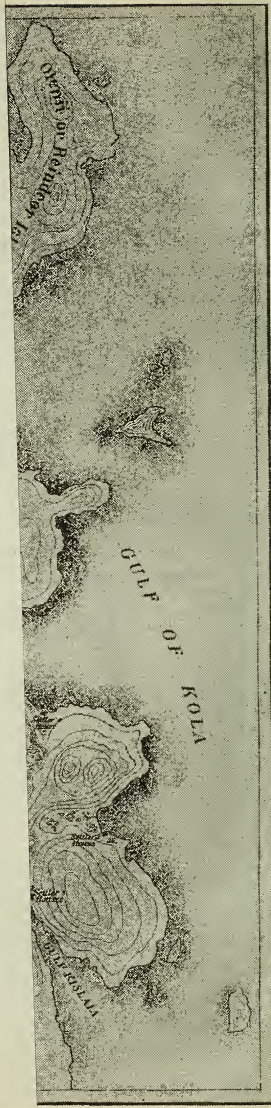
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E. TEMPERATURE.—Observations taken at the meteorological station at Yekaterina Harbor (about 25 miles north of Murmansk) during 1894–1897 showed the following mean temperatures :

	°F.
End of March to middle of June.....	37
Middle of June to beginning of August.....	52
Beginning of August to middle of October.....	38
Middle of October to end of March.....	19

Mr. Goriachovsky, constructing engineer of the Murman Railway, gives the mean temperature as 14° F. in winter and as 55° F. in summer.

In winter, along the coast region, the thermometer rarely goes below 5° to 10° F. Early mornings when the mercury goes to 32°, and occasional snowstorms, are fairly frequent up to the middle of June. In the interior of the peninsula the mean temperatures are 4° F. in winter and 55° F. in summer.

Average temperature at Kola 1878–1888.

Month.	Mean.	Mean high.	Mean low.
	° F.	° F.	° F.
January.....	12	33	—24
February.....	13	34	—21
March.....	19	40	—12
April.....	28	47	7
May.....	38	61	22
June.....	48	75	35
July.....	53	82	40
August.....	53	75	40
September.....	43	60	27
October.....	31	46	10
November.....	19	38	—13
December.....	10	33	—27

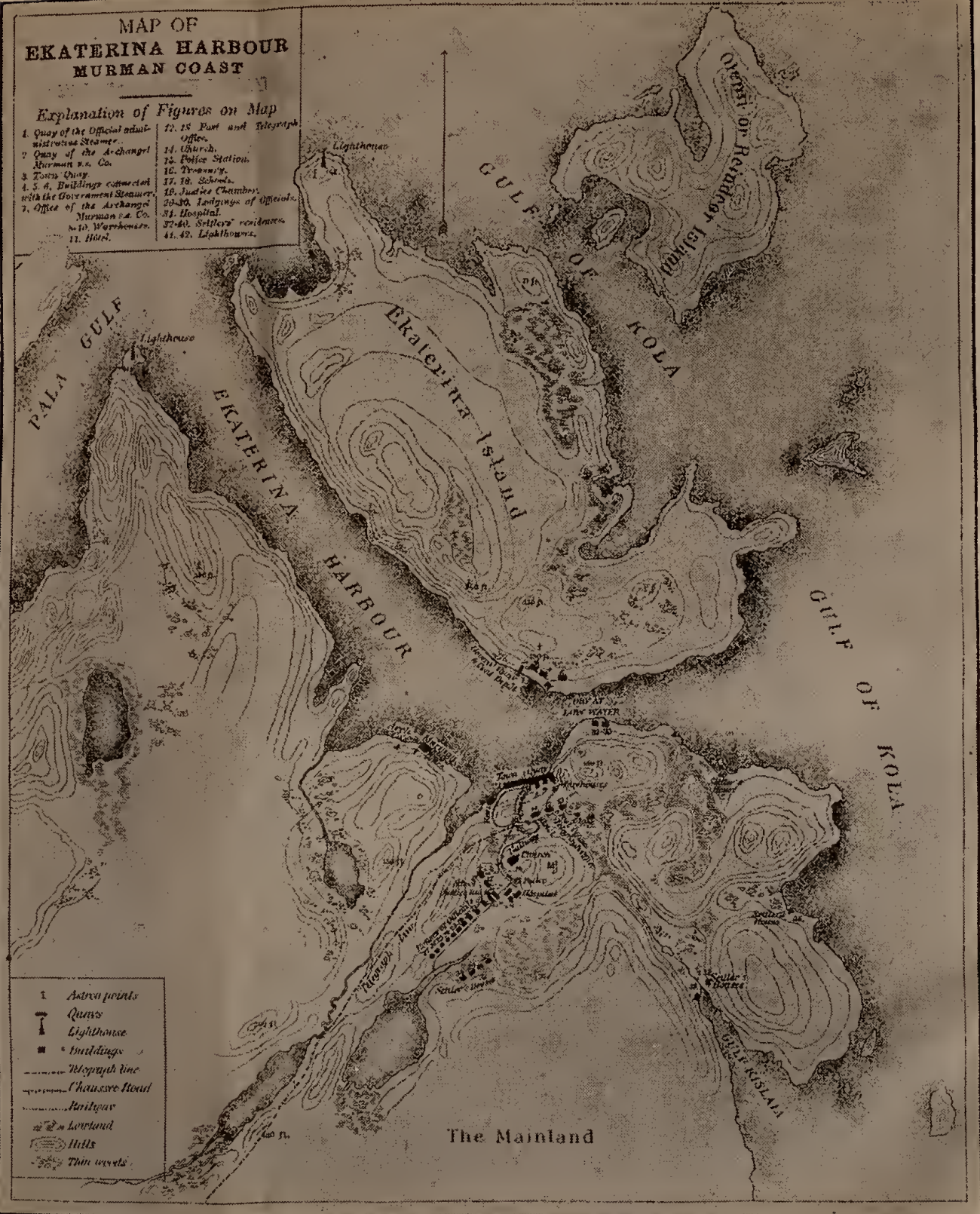
In the White Sea coast region the mercury falls as low as —35° F.

F. WINDS.—In the spring, northwest winds prevail off the Murman coast, bringing dull weather with fog, rain, and snow.

MAP OF EKATERINA HARBOUR MURMAN COAST

Explanation of Figures on Map

1. Quay of the Official administrative Steamer.
2. Quay of the Archangel Murman s.s. Co.
3. Town Quay.
- 4, 5, 6. Buildings connected with the Government Steamer.
7. Office of the Archangel Murman s.s. Co.
- 8, 9. Warehouses.
10. Hotel.
11. Lighthouse.
- 12, 13. Post and Telegraph Office.
14. Church.
15. Police Station.
16. Treasury.
- 17, 18. Schools.
19. Justice Chambers.
- 20-23. Lodgings of Officials.
24. Hospital.
- 25-28. Soldiers' residences.
- 29, 30. Lighthouses.



In the early spring, however, south to southeast winds bring fine but cold weather, it being especially cold with the south-southeast wind, which sometimes blows in violent squalls.

In summer the prevailing winds are from the north, northeast, and east. These bring cold and hazy weather with fog. While the other two are usually of short duration, the northeast wind sometimes blows steadily for weeks at a time. At times a southwest wind blows in squalls with heavy rain and with thunderstorms from the northeast. Calms are rare.

In autumn the southwest wind begins to prevail, but there are frequent north winds, which are usually fresh.

In winter the most favorable wind, and the prevailing one, is the southwest, which brings rain and cold weather. The best winter weather is during easterly winds, when the thermometer falls toward zero.

The above notes apply more particularly to the Murman coast section. Throughout the whole of the White Sea region fine weather occurs most frequently with easterly and southerly winds. The Gulf of Onega and Kandalaksha Bay, however, are exceptions, the finest weather occurring in those places with a southwest wind, which brings a cloudless sky. In the region, as a whole, fine weather is rare in autumn and occurs only with light, southerly winds; in winter, with an east wind.

NAVIGATION.

MURMAN COAST.—The polar ice never reaches the Murman coast, usually not coming within 200 miles of it. The nearest it is ever reported to have come is 20 miles, but even that is doubtful. Off the coast the sea never freezes and the gulfs and bays are accessible to steam vessels at all seasons. Strictly speaking, only the heads of bays such as Kola and Pechenga Inlets, which run into the land for some distance, or those which connect with the sea by narrow and shallow entrances, become frozen. In the inlets the ice usually freezes only from 3 to 8 inches thick, although it becomes much thicker

at the heads of certain bays, particularly those which receive the fresh water of rivers. The most severe climate of all Murman is at the heads of Varanger Fjord and Pechenga and Paza Gulfs, in all of which the ice attains a thickness of 2 feet and does not break up until the end of May. The northern part of Kola Inlet, the harbor of Alexandrovsk, and the port of Murmansk are open all the year.

WHITE SEA.—In the White Sea ice appears sometimes in October, more frequently in November and December, and sometimes not until January. The whole area of the White Sea is never covered with floe ice, although a fringe of sheet ice extends out perhaps 3 miles from shore. The Gorlo, or throat of the sea, where its waters join the Arctic, never becomes solidly frozen on account of the strong current, but does become choked with drifting ice. The date of the opening of navigation depends on the conditions in the Gorlo, which may become clear anywhere from the 20th of April to the middle of June. The duration of navigation in the White Sea under the most favorable conditions may be taken as 6 months (May to November), for sailing vessels, 8 months (May to January) for the ordinary steam vessels, and 10 months (May to March) for the steamers of the ice-breaking type.

ARCHANGEL.—Archangel is thus a closed port for a part of each year, while Murmansk is open to navigation at all seasons. This was the determining factor in building the Murman railroad to parallel the shorter Archangel-Vologda line. During the winter season the Murman road supplements the other.

POPULATION.

The Kola Peninsula, which, under the old régime, constituted Alexandrovsk District, embraces an area of about 57,000 square miles. Before the railroad was built the population numbered about 14,300 (or about 1 person to 4 square miles), and consisted of Russians, Lapps, Karelians (Finns), and Norwegians. Now the population is about 25,000, mostly Russians. Of this

number about 8,500 live in colonies scattered along the Murman coast. Of these 76 per cent are true Russians, 12 per cent Finns, 6 per cent Karelians and Lapps, and 6 per cent Norwegians. All together there are 54 of these colonies along the coast. The people live in "cantonments" (stanovische), or small, closely huddled villages, those of Gavrilovo and Teriberla (about 60 and 70 miles east of Kola Bay) being the largest. (For view of Gavrilovo, see illustration 8.)

The following table gives a list of these settlements and their population in 1899:

SETTLEMENTS TO THE WEST OF THE GULF OF KOLA.

	Popula- tion.		Popula- tion.
1. Yekaterina Harbor.....	71	18. Zubovski Islands.....	18
2. Saida-guba.....	30	19. Vaida-guba.....	63
3. Toros Island.....	18	20. Chervianaia.....	56
4. Eritiki or Port Vladimir....	4	21. Zemlianaia.....	173
5. Ura-guba.....	238	22. Malaia-Volokovaia.....	24
6. Chan Brook.....	27	23. Gagarka.....	63
7. Medvied (or Bear) Island...	7	24. Olenia - Gorka (Reindeer Hill).....	28
8. Bolshaia Lopatka.....	15	25. Triphonoff Brook ¹	51
9. Kisslaia-guba.....	10	26. Barakino ¹	58
10. Vichani.....	16	27. Kniazukha ¹	141
11. Malaia Litza.....	29	28. Pechenga ¹	100
12. Bolshaia Litza.....	62	29. Finmanskaia.....	13
13. Kitovka.....	4	30. Voriema.....	8
14. Kutovaia.....	9		
15. Bolshaia Motka.....	101		
16. Eina.....	5	Total.....	1,544
17. Tsip-Navolok.....	57		

¹ In the Gulf of Pechenga.

SETTLEMENTS TO THE EAST OF THE GULF OF KOLA.

1. Vostochnaia Litza.....	28	10. Kildin.....	11
2. Harlovka.....	14	11. Tiuva-guba.....	10
3. Rinda.....	41	12. Srednaia-guba.....	16
4. Triastchino.....	5	13. Griaznaia-guba.....	18
5. Schelpino.....	12	14. Rossliakova-guba.....	5
6. Gavrilovo.....	47	19. Bielokamennaia.....	22
7. Golitizino.....	54		
8. Teriberla.....	193	Total.....	483
9. Zaolenie.....	7		

The Lapps are almost the sole inhabitants of the interior of the Kola Peninsula. They lead a seminomadic life, each group having a summer and winter settlement (pagost). The latter are usually inland near the forests, where the Lapps herd their reindeer, and the former near the coasts and lakes, for the fishing. The dwellings in winter are small, sod-covered huts, and in summer bark and turf wigwams. (For scenes of Lapp life see illustrations 9-11.)

The Pomors ("those by the sea"), who dwell farther south in Pomorya, are descendents of Novgorod Russians and much more enterprising and energetic than the Karelians. They are chiefly occupied in the fisheries on the Murman coast, to which the men voyage in the season. In winter many are engaged in shipbuilding. Their larger settlements are to the southeast of Kem, including Shuyaretskaya (170 houses), Soroka (250), Shezhma (200), Sukhonavolok (125), Virma (70), Suma (280), Kolezhma (140), and Nyukha (260). (Date 1899.) From Kandalaksha southeast, along the gulf and toward Kem, their larger villages are Knyazhya Guba (50 houses), Kovda (65), Chernoretskaya (40), Keret (115), Gridino (20), Pongoma (30), and Lyetneryetskaya (35). (For types of Pomars see illustration 12.)

The Karelians are a Finnish tribe, who overran the White Sea coast region in the fourteenth century. They live generally south of the Pomorya in Karelia, but there is no distinct boundary. Their chief occupations are agriculture, felling timber, fishing, hunting, and transporting goods by pack to Finland. Their villages are scattered about the banks of rivers and lakes, which mainly lie in a south and southwestern direction. Their homesteads, especially in the western parts, are scattered over areas of 2 or 3 miles.

COMMUNICATIONS.

A. COASTWISE ROUTES.—Communication along the Murman coast is carried on throughout the whole of the year by

steamships and small boats. During the summer, from early in June to the end of September, a line of mail passenger steamships is maintained between Murman and Archangel. Even during the winter a steamer makes a number of trips between the more important cantonments, going as far west as Vardö, the chief point of the fish trade between the Russians and Norwegians. From early spring to autumn the Russian sailing ships of the cod fleet are loaded at Vardö, whence they transport the fish to Archangel. In summer communication with the interior of the peninsula is generally by water; in winter, by reindeer sledges. Each animal can draw 2 poods (about 72 pounds), each sledge being usually drawn by 4 deer. They work best in the first months of winter, becoming weaker from work and lack of food toward spring. The deer are used for food, clothing, and traveling. In summer, when not wanted for the latter purpose, they are allowed to roam at large, and generally flock to the heights of the Chibinski Mountains or the seashore to avoid the gadflies and mosquitoes. They require hardly any care throughout the year, feeding in summer on various grasses and in winter on the "reindeer lichen," which they dig out from under the snow.

B. ROUTES FROM THE COAST.—1. **Murmansk:** There are three points of entry in western Russia whence the routes start inland from the Arctic. The most important of these routes, in so far as it is open at all seasons, is now the Murman Railway, running south from Murmansk to the Vologda-Petrograd line, which it joins at Zvanka. This route is described in detail later, but in general may be said to connect the villages along the base line of the Kola Peninsula and all the important ports on the western coast of the White Sea.

2. **Pechenga.**—Pechenga is situated on Pechenga Inlet, about 18 miles from the seacoast and about 65 miles northwest of Murmansk. A fine road runs from the coast to the village, and from that place a new wagon road, built since the war, runs about 100 miles southwest to Kiro. It passes through wild

country which would be very difficult for railroad construction. From Kyro a fair road, over which a Ford car has passed, leads to Rovaniemi, 190 miles west by south of Kandalaksha, via Sodankyla. Rovaniemi was the northern terminus of the Finnish Railway, which runs to Kemi (65 miles), at the head of the Gulf of Bothnia. (See below.) Still another alternative route for this northern section is up the Pasvik River (on which Boris Glob is located), through Lake Enare to the village of Enare, and thence along the Kyro-Sodankyla-Rovaniemi road. Along the road from Kyro to Rovaniemi wood and supplies can be obtained every dozen miles, and there are small houses for passing the night. Most of the settlements are groups of 3 or 4 houses only, but a few have from 12 to 40 or 50. The entire route from Pechenga to Rovaniemi can be traveled at any time of the year, but is better in winter. There would be difficulty in securing feed for horses. Pechenga is a fair-sized village, with macadam roads and a big monastery of the Greek Church. It has a better harbor than Alexandrovsk, and a Russian squadron, including large battleships, anchored there in 1907 or 1908. It is necessary to land in small boats, but a mole could be built. (For scenes near Pechenga, see illustrations 13-15.)

A late report, August 22, 1918, states that the Germans have extended the Kemi-Rovaniemi Railroad about 110 miles to the north and are building at the rate of 6 miles a day. The northern terminus is unknown. The new extension is said to serve the following places: Apukka, Vikajarvi, Ylinampa, Hoikka, Vuojarvi, Torvinen, Yliaska, Orsakoski, and to have reached Sodankyla. Up to this point the construction has been relatively easy, the country being rocky. Further on the ground becomes marshy and the difficulties will be greatly increased.

3. Archangel.—There is no other route to the interior from the coast west of the Archangel-Vologda Railway route and the Dvina River route, both of which start from the port of Arch-

angel on the eastern shore of the White Sea. As already noted, this port is closed by ice for several months in winter.

C. ROUTES BETWEEN INTERIOR POINTS.—The entire country traversed by the Murman Railway north of Lake Onega is almost wholly devoid of wagon roads. In the Kola Peninsula there are none whatever. During the winter reindeer and sledges follow certain established routes between the various villages. (See illustration 16.) Such sledge travel, however, does not give rise to permanent trails and is possible only when snow covers the ground. Similar conditions prevail not only in the Kola Peninsula but in the region farther west and in the neighboring region west of the White Sea. Only when one proceeds westward into Finland or south of the White Sea does he find actual roads. Nevertheless some of the sledge routes are here mentioned in addition, because they might be used by an enemy in an attempt to cut the Murman Railroad from the west.

1. **Routes from Kandalaksha.**—From Kandalaksha a route proceeds, partly by water and partly by land, to Allakurti, about 60 miles west of Kandalaksha. It is said to be possible to reach Allakurti also by way of Lake Kovda. The ice clears out of this lake about the middle of June. From Allakurti, which is west of the Finnish border, a wagon road runs to Rovaniemi via Sallatunturi (which lies about 85 miles west by south of Kandalaksha) and Kemtrisk. From Kemtrisk to Rovaniemi the road is good.

The other route between Kandalaksha and the Gulf of Bothnia runs 125 miles southwest to Kuusamo, to which point it can scarcely be called even a trail. Thence to Uleaborg, on the Gulf of Bothnia, it is good enough for automobiles. The villages along the route are small and widely scattered. The country is hilly and full of lakes and streams. In many places trails cut off bends of the wagon road, while elsewhere the native traveler often helps himself forward by means of canoes on the rivers.

Canoe traffic is so important that in summer the route via a chain of lakes called Rugo, about 55 miles southwest of Kandalaksha, forms the easiest link in the route to Uleaborg.

The importance of the neck of land between the head of the Gulf of Bothnia and Kandalaksha Bay on the White Sea may be judged from the fact that the Germans and Finns are reported to be building a railroad from the former rail head at Rovaniemi to Kovda, about 30 miles south of Kandalaksha. According to Mr. Goriachkovsky, the engineer of the Murman Railway, such a connection between the Finnish Railroad and the Murman Railroad would be possible but very difficult. The railroad could start either from Rovaniemi or Uleaborg. Another possibility would be to build a road farther south from Lieksa in Finland to Kem or Soroka on the White Sea. In any case the engineers could find scarcely any population and no food, horses, or vehicles. All supplies as well as the material for the construction of the railroad would have to be brought from Finland. The only exception would be timber. Which ever route is chosen, the distance is about the same—namely, 220 miles. The difficulties of building such a road may be judged from the fact that when the part of the Murman Railroad between Soroka and Petrozavodsk was constructed it was possible to start work at four places, using the White Sea and Lake Onega as means of communication, yet the work took a year. The Germans, on the other hand, in constructing a line of equal length from Finland to the Murman line would have only one starting point—namely, from their Finnish base.

In this connection it should be noted that rails can not be laid on the ice in winter, as is done in Siberia. Rapids are so numerous that the water in the rivers does not freeze in many places, nor is the climate cold enough to produce thick ice on the lakes. Even in January and February the peasants between Soroka and Lieksa were found to be afraid to cross the lakes on sledges. The heavy snow loads the ice so greatly that

the ice is carried down into the water. In the swamps, however, the ice is from 1 to 2 feet thick and can be used for light tracks.

2. Routes from Kem.—From this station on the Murman Railway a route also runs to Ukhta (about 100 miles west) by river and lake. There is a good road from Kiantajarvil (about 55 miles W. by S. of Ukhta) to Uleaborg, via Puolanka and Utajarvi. Reports dated July 26, 1918, indicate that the Germans have built a wagon road from Kem, via Kiantajarvil (Suuomussalmi) to Kajana (the head of one of the Finnish Railway lines).

3. Routes from Soroka.—*To the north:* There is no road for wheeled traffic leading north.

To the east: A very bad road runs southeast about 30 miles to Suma, on the southern shore of the White Sea. Here the road divides and one branch runs eastward to the station Oberzeskaya, about 80 miles south of Archangel, on the Archangel-Vologda Railroad. There are also trails leading to the same station from Suma. There is a steamer service in summer between Soroka and Archangel.

To the south: The road above named is followed to Suma and the southern branch taken at that point. The road parallels the railroad, some distance east, to the town of Povenetz. There it turns west and meets the railway at Medvyezhyia Gora, whence it continues south to Petrozavodsk. This is a good road from Suma south.

To the west: In summer the region toward the Finnish frontier is absolutely impassable. A trail, rough even in winter, runs from Soroka to Lieksa, on the Viborg-Narmes Railway in Finland. The journey takes $4\frac{1}{2}$ days and nights.

4. Routes from Petrozavodsk.—*Land routes:* The road mentioned above as running south from Medvyezhyia Gora to Petrozavodsk continues from the latter in a southwestward direction to Olonetz, and thence around the northern shore of Lake Ladoga to Sardaval. A branch from Olonetz also runs around

the southern shore of Lake Ladoga to Petrograd. These are good roads.

A poor road also leads from Petrozavodsk along the shore of Lake Onega to the south of that lake, where it joins what is said to be a very good road from Lodeinoye Polye, and continues east to Plesetskaya on the Archangel-Vologda line, about 132 miles south of Archangel.

Water routes: There is also from this station an alternative route in summer to Petrograd by way of Lake Onega, the Svir River, and Lake Ladoga. (For details, see under Petrozavodsk, in the route notes.) The town is also connected with the River Volga. The route is across Lake Onega to the village Voznesenie, and from there by the Marinski Canal system and the River Sheksna to the town of Rybinsk (in all, 440 miles). From the village Voznesenie connection is also made, through the canal system of the Grand Duke of Würtemberg, with Vologda (295 miles).

From Petrozavodsk, or Medvyezhyia Gora, there is thus direct connection by water with all the towns along the Northern Dvina, Volga, and Neva. Onega Lake is open for navigation from May till October, inclusive. It is very stormy in October, but the barges are of specially strong construction. On the canals and Dvina and Volga Rivers there is a large fleet of river boats and tugs. In winter they are docked in the quiet harbor of Voznesenie.

5. Route from Lodeinoye Polye.—A good road leads to Plesetskaya (on the Archangel-Vologda Railway, 132 miles south of Archangel) via Urytegra and Karvopol. It continues thence to the Dvina River and follows it up to Archangel. Horses are obtainable and automobiles can be used.

6. Communication with Archangel-Vologda Line.—The country between the two lines is a vast wilderness of swamp and forest, and communication between them, except along the roads indicated, would be exceedingly difficult. The White Sea, which affords water communication in summer, is blocked by ice in

winter, but does not freeze solidly except along the shore. It might be possible to follow the southern shore line on the ice from Kem or Soroka to Archangel in specially equipped motor cars, using snowplows. Communication could also be maintained by use of the modified form of hydroplane, recently perfected we understand by the Canadian Government, which can be used to land on deep snow.

STRATEGIC POINTS.

The topographical conditions of the Murman region are such that in the north an enemy would have little chance of seizing the railroad. Farther south the places chiefly exposed to attack are as follows:

1. **KANDALAKSHA.**—This point can be reached by sea, and it is also the terminus of a poor route from the west via Sokolozero and Allakurti. The latter lies 60 miles west of Kandalaksha.

2. **KEM.**—This place is also exposed to attack from the White Sea, and is the terminus of a route from the west. The nearest concentration point along this route is Ukhta, about 100 miles west of Kem. At proper season there is transportation by river and lake much of the way from Ukhta to Kem. It was reported in May, 1918, that barracks capable of housing 12,000 men were being erected at Ukhta, but how far this work progressed is not known. Kem might also be exposed to attack along the line of a wagon road which is reported to have been built during the summer of 1918 from Kajana, the head of one of the Finnish railways, via Kianta (Suomussalmi) to Kem. The exact location of this road is not certain, but it probably passes through Ukhta.

3. **SOROKA.**—This place is subject to attack from the White Sea, and is also the terminus of a poor road from Archangel, and of another route which comes from the south, parallel to the railroad, but at a distance of 10 to 30 miles to the east.

4. **MEDVYEZHA GORA.**—This place is open to attack from Lake Onega, and also by means of poor wagon roads from the east. From the west it could be approached by way of Joonsu on the Finnish Railway, 70 miles north of west of Sardavala, and thence via Keskiarvi to Marussari.

5. **PETROZAVODSK.**—Here there is a way of approach from Lake Onega on the east and by a good wagon road on the southwest. From Petrograd boats can cross Ladoga Lake, so that Petrozavodsk would be comparatively easy to attack.

6. **ZVANKA.**—This is much the most important point upon the whole line. It is the junction of the Trans-Siberian and Murman Railroads. It can be approached not merely along the line of the Trans-Siberian and Murman Railroads, but by a railroad from the southwest and by wagon roads from the same quarter, and also by a good wagon road from Lake Ladoga, a few miles to the north.

FOOD AND SUPPLIES.

A. AGRICULTURAL PRODUCTS.—There is scarcely any agriculture. In the Lapp settlements in the Kola Peninsula and the Murman colonist districts a small quantity of potatoes is raised, the yield being from three to six fold. In 1914 the yield of hay throughout the entire region was about 2,700 tons.

In the Pomorya (White Sea coast region) but little more is done agriculturally. In the year 1914 the total cultivated area in the Kem and Onega districts of that section did not exceed 33,750 acres. The crops are rye, barley, potatoes, and oats, the yield of winter grain varying from two and one-half to six times the quantity sown. Foodstuffs are imported from Finland and from Archangel, the chief imports from the latter place being rye, flour, buckwheat, wheat, oats, hay, salt, and petroleum products.

There has been a constant lack of hay in Pomorya so that in years of shortage it has been necessary to feed the cattle leaves of trees, and the impossibility of importing hay has had an effect both on cattle raising and agriculture.

B. FISH.—The main native food supply consists of the various kinds of fish, with which both the inland waters and the sea are filled. In the Murman region alone between 4,000 and 4,800 men are engaged in this industry. The chief fish are the cod, herring, and salmon. The methods of catching them are still very primitive. Of the approximately 1,170 boats employed on the Murman coast, at least 80 per cent are of the "shnyaka" or "yela" type, the former an undecked, heavy, clumsy rowboat, carrying from 700 to 1,000 pounds and manned by three or four men. The latter is also an undecked boat, but considerably lighter. (For type of boat in use, see illustration 17.) The fishing along the Murman coast is carried on from the beginning of April to late autumn, but the most abundant stream fisheries can not be taken advantage of on account of the absence of communication during the other months. On the Pomorya coast herrings and navaja are caught from October to the beginning of January, and the small salmon from midsummer to late autumn. In the sea near the Murman coast there are large numbers of sharks, and along the shores of the peninsula and the Pomorya are also great quantities of sturgeon, seals, and walrus.

C. LUMBER.—Besides the fishing, the only trade of any importance is lumber, and the only supplies found in abundance are lumber products. There are sawmills at Soroka, Kem, Keret, and Kovda, and beams, planks, railroad ties, laths, firewood, etc., form almost the entire export business of the western White Sea ports.

The abundant supply of lumber has given rise to shipbuilding at certain points such as Shuma, Kem, Nyukha, Soroka, and Shuya, the inhabitants being expert at their trade. There is, however, difficulty in obtaining the necessary materials, other than lumber.

THE RAILWAY.

A. CONSTRUCTION.—On January 1, 1915, Mr. Vladamir Goriachkovsky was appointed engineer by the Russian Govern-

ment. Survey was started immediately and construction begun at the railway station at Petrozavodsk. One hundred thousand Russian workmen were employed from all parts of the country. Germany gave high mortality reports, but the death rate was extremely low. The workmen lived under primitive conditions, mostly in tents, and many developed scurvy, but not more than 1 per cent of those taken ill died.

Soundings were fathomed through the ice during the winter by means of special long iron rods to determine earth contours, in order to establish the best roadbed in swampy country. Surveys were made in the long Polar night by the light of lamps. Swamps were dredged and roadbeds ballasted on a large scale by the use of American steam shovels. By November, 1916, 10,000,000 cubic meters of earth had been excavated and more than 1,000,000 cubic meters of earth had been blown up by dynamite.

B. ROADBED.—The total length of the new part of the railway is about 660 miles. To date no serious incident of the roadbed sinking in swamps, due to the spring thaws, has occurred, though some sections of the track are not ballasted and the roadbed is bad. There is some danger of washouts with the spring floods, the worst section possibly being north of Kandalaksha. General condition was good in April, 1918. The Murman Railway may be considered serviceable the year round, although its condition is better in winter than in summer. The gauge is the standard Russian one, 5 feet.

C. BRIDGES.—There are 1,110 bridges, totaling about 18,000 yards.

D. STATIONS.—The railway is provided with 54 stations, about 18 miles apart on the average, with water supply, dwellings, and materials.

E. SIDINGS.—Siding are from 5 to 7 miles from each other.

F. GRADES.—Grades ($1\frac{1}{2}$ per cent) are quite heavy and much steeper than on the Archangel road. Consequently it is

not possible to handle the same amount of goods. From Bujarskaya to Soroka there was very little elevation to overcome.

G. CAPACITY.—In 1916-17 the average number of cars loaded with war goods and run in a day is stated to have been 120. Since then the roadbed and facilities of the line in general have been improved. Mr. Goriachkovsky estimates that by using only the first-class sidings laid between the stations, with an average of 12 miles between them, 13 trains in one day can easily pass, also that the number could be increased to 23 by operating the finished sidings of the second class. At present, with the smallest radius of curve 1,000 feet, grades of $1\frac{1}{2}$ per cent and rails of $22\frac{1}{2}$ pounds to the foot, an average Russian locomotive could easily pull a train of 23 loaded cars. The capacity of a car is 1,000 poods, equal to 36,000 English pounds. This estimate of the road's present capacity is considered excessive by some others familiar with the road.

H. ROLLING STOCK.—There is a fair amount of rolling stock on the line, including an armored train. With sufficient rolling stock, 200 cars daily, perhaps, could be run over the line. It would also be necessary to have materials for repairs and a central locomotive shop for big repairs, in addition to the present facilities at Petrozavodsk. (For type of locomotive, see illustration 18.)

I. FUEL.—The locomotives burn either wood or coal. Green wood gives bad results and it is necessary to prepare and dry it a year in advance. Forty-nine cubic feet of wood is equivalent to 110 pounds of English coal. Only birch is used when possible. There is now no dry wood, and coal must be imported from England. During the transportation period in 1916-17 the road consumed about 30,000 tons of English coal, in addition to the wood prepared in 1916.

J. DISTANCES.

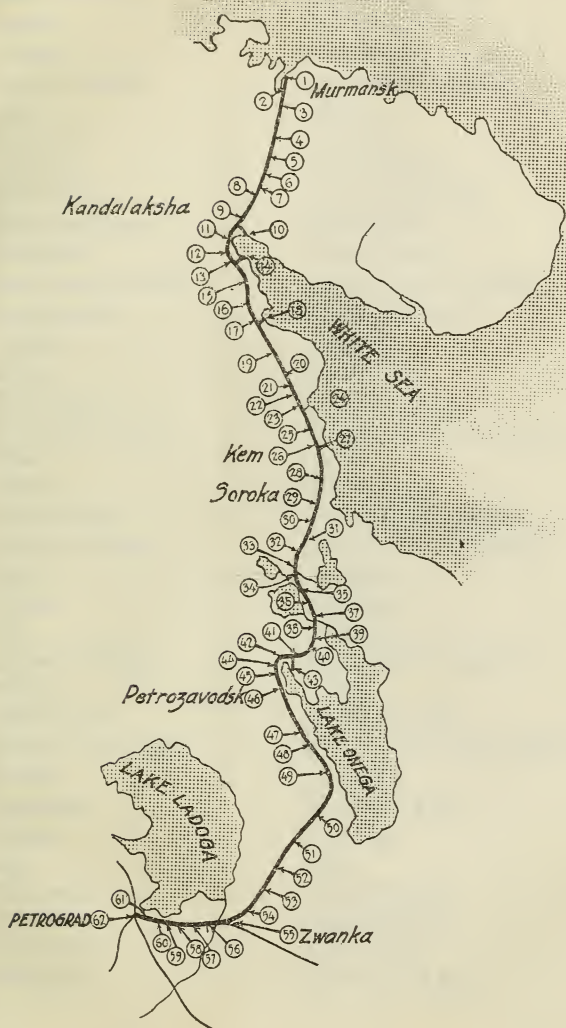
	Between stations.		From Murmansk.	
	<i>Miles.</i>	<i>Versts.</i>	<i>Miles.</i>	<i>Versts.</i>
Murmansk.....				
Imandra.....	97	137	97	137
Kandalaksha.....	80	121	171	258
Polyarni Krug.....	64	96	235	354
Kem.....	146	220	381	574
Soroka.....	37	56	418	630
Maselskaya.....	133	200	550	830
Petrozavodsk.....	103	156	654	986
Lodeinoye Polye.....	93	140	745	1,126
Zvanka.....	74	111	820	1,237
Petrograd.....	84	127	904	1,364

MURMAN RAILWAY.

MURMANSK TO PETROGRAD.

LIST OF STATIONS.

1. Murmansk	МУРМАНСКЪ
2. Kola	КОЛА
3. Loparskaya	ЛОПАРСКАЯ
4. Pulozero	ПУЛОЗЕРО
5. Olenya	ОЛЕНЬЯ
6. Imandra	ИМАНДРА
7. Tikozero	ТИКОЗЕРО
8. Niva	НИВА
9. Kandalaksha	КАНДАЛАКША
10. Kandalaksha Harbor	КАНДАЛАКША-ПРИСТАНЬ
11. Byeloye-More	БѢЛОЕ МОРЕ
12. Zhemchuzhnaya	ЖЕМЧУЖНАЯ
13. Knyazhya Guba	КНЯЖЬЯ ГУБА
14. Knyazhya Guba Harbor	КНЯЖЬЯ ГУБА-ПРИСТАНЬ
15. Kovda	КОВДА
16. Polyarni Krug	ПОЛЯРНЫЙ КРУГЪ
17. Chupa	ЧУПА
18. Chupa Harbor	ЧУПА-ПРИСТАНЬ
19. Keret	КЕРЕТЪ
20. Boyarskaya	БОЯРСКАЯ
21. Engozero	ЭНГОЗЕРО
22. Sig	СИГЪ
23. Pongoma	ПОНЬГОМА
24. Pongoma Harbor	ПОНЬГОМА-ПРИСТАНЬ
25. Lyetneryetskaya	ЛѢТНЕРЬЦКАЯ
26. Kem	КЕМЪ
27. Kem Harbor	КЕМЪ-ПРИСТАНЬ



28. Shuyeretskaya	ШУЕРЪЦКАЯ
29. Soroka	СОРОКА
30. Olimpi	ОЛИМПІЙ
31. Parandovskoye	ПАРАНДОВСКОЕ
32. Onda	ОНДА
33. Segezha	СЕГЕЖА
34. Urosozero	УРОСОЗЕРО
35. Maselskaya	МАСЕЛЬСКАЯ
36. Segozero Harbor	СЕГОЗЕРО
37. Lumbushi	ЛУМБУШИ
38. Medvyezhyia Gora	МЕДВѢЖЬЯ ГОРА
39. Kyapeselga	КЯПЕСЕЛЬГА
40. Lizhma	ЛИЖМА
41. Kivach	КИВАЧЬ
42. Kondopoga	КОНДОПОГА
43. Kondopoga Harbor	КОНДОПОГА-ПРИСТАНЬ
44. Suna	СУНА
45. Shuiski	ШУЙСКІЙ
46. Petrozavodsk	ПЕТРОЗАВОДСКЪ
47. Pyazheva Selga	ПЯЖЕВА-СЕЛЬГА
48. Ladva	ЛАДВА
49. Tokari	ТОКАРИ
50. Svir	СВИРЬ
51. Lodeinoye Polye	ЛОДЕЙНОЕ ПОЛЕ
52. Pasha	ПАША
53. Kolchanovo	КОЛЧАНОВО
54. Michael Archangel	МИХАЙЛО-АРХАНГЕЛЬСКЪ
55. Zvanka	ЗВАНКА
56. Voibokala	ВОЙБОКАЛА
57. Naziya	НАЗЫЯ
58. Mga	МГА
59. Sapernaya	САПЕРНАЯ
60. Rybatskoye	РЫБАЦКОЕ
61. Obukhovo	ОБУХОВО
62. Petrograd	ПЕТРОГРАДЪ

ROUTE A.

MURMANSK TO PETROGRAD.

DETAILED DESCRIPTION.

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Alexandrovsk.—Population, 600. This town is not on the line of the railway, but about 25 miles north of Murmansk. It is located on Yekaterina Harbor and was founded in 1899 as a Russian naval base, but not completed. It is the capital of Alexandrovsk District, which formerly included the whole Kola Peninsula. The administrative departments and buildings are here and also a biological station. There are no traders and the place plays no rôle in the economic life of the peninsula. (See illustrations 19 and 20.)

0 0 **Murmansk.**

Location.—The city is situated on the eastern shore of Kola Inlet, about 25 miles from the entrance.

Population.—The city has an estimated population of 3,500 to 4,000, to which should be added refugees, the number of whom varies at different times from a few hundred to possibly 2,500 or 3,000.

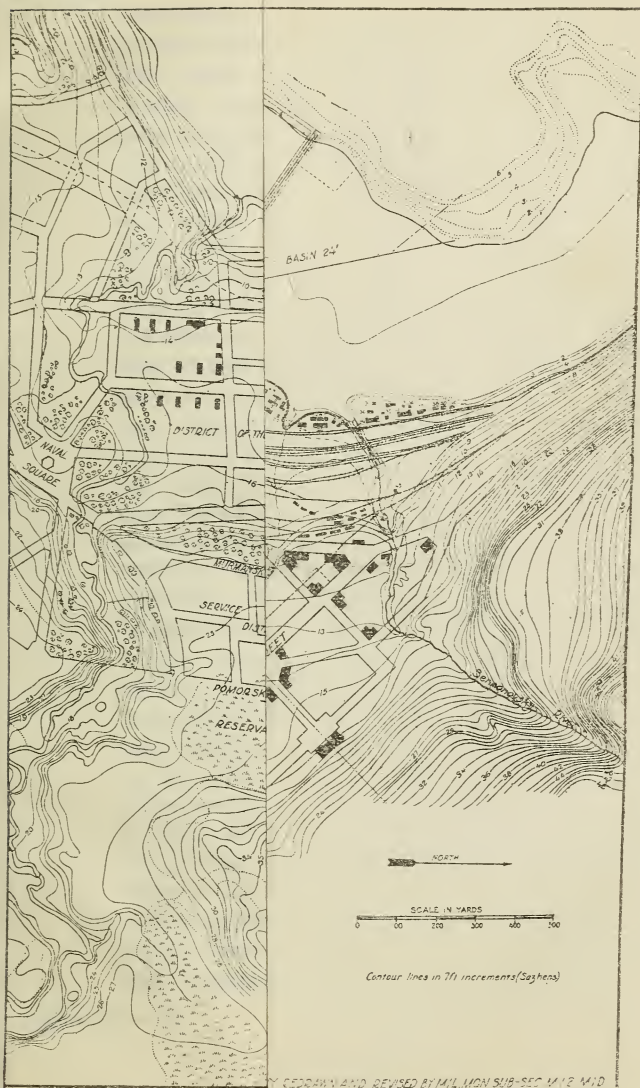
Description of city.—As may be seen from map No. 4, the city as planned was to be divided into districts, such as port district, naval base, market, labor, service, White Sea, and administration districts. The revolution interfered with the rapid

Miles. Versts.

building of the city as planned, and birch-tree groves are still growing with streets cut through them. The town at present consists of about 300 buildings, nearly all located in the port, labor, and naval base districts. They are mostly of one story, and built of pine logs pieced together by mortised joints. The spaces between the logs are for the most part packed with native moss. The buildings consist mostly of dwellings, storehouses, offices, and barracks. The latter are mainly used as storehouses at present. There are dwelling accommodations for at least 4,000 men. During the period of 1916-17 more than 8,000 people were living here. There is a fire department, cabinet-workers' shop, small church, and a few assembly halls. France, England, and the United States have consulates. The Y. M. C. A. building is in process of erection. The streets are entirely of dirt, graded, usually with a slight camber to form a watershed and with ditches running along the sides to carry the water away. The military camp, the so-called naval base, is situated a little south of the town line. It has cottages for officers, barracks for soldiers, and storehouses.

Harbor and docks.—The inlet is $1\frac{1}{2}$ miles wide here, 32 feet deep near the piers, and 70 feet in the middle. The tide rises 11 feet. There are no hidden rocks or shoals, and the bottom is soft, muddy sand. Just outside of low-water line the water is very deep, which makes harbor construction easy. The shores are sloping and are of sand and clay. On both sides of the inlet are hills 300 to 400 feet high, which rise from near the water. The bay and inlet of Kola have a peculiar form

"Murman Railway and Kola Peninsula"



Contour lines in 7ft increments (Sazhens)

PLAN OF THE TOWN OF MURMANSK

To accompany Military Monograph Handbook on " Murman Railway and Kola Peninsula "



ORIGINALLY BY NAVAL RECORDS AND REVISED BY MIL. MON. SUB. SEC. 1212 MID
S.B.

Miles. Versts.

which not only protects this harbor from storms but also from submarines. On account of the currents, due to the curved shores, a submarine is obliged to come to the surface twice while approaching the harbor, and can be fired upon by shore batteries. There is also a double net stretched across. The inlet has no currents and large ships can be shifted from one side of the pier to the other without tugs. There is anchorage space for a large number of ships. In the winter of 1916-17 there were over 20 ocean steamers there at once. In the harbor construction the type of separate piers was adopted. They were to have railroad tracks and moveable cranes of 20 tons capacity. The southern one has been completed and is very substantially built. It has berthing space for five to seven large steamers and a capacity of about 3,500 tons a day. Vessels of the deepest draft may be accommodated at any stage of the tide. The pier has seven tracks leading to the main line. The northern pier, shown on map No. 2, is only partially completed. It could be finished within a short time. (See illustration 21.) North of the town, beyond the Green Cape, are yards for explosives, with a branch rail line running there and another uncompleted dock. Opposite the town, on the western side of the inlet, is a pier where water may be obtained. The trough, about 8 inches in size, leads the length of the pier and carries water from the hills to the end of the dock. It is suitable for boiler and cleaning purposes but is not recommended for drinking. At last reports (July, 1918) there were two water barges in the port; one of them in commission and the other being

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fitted up. Each had a capacity of approximately 250 tons of water. Only small craft, drawing about 12 feet, can go alongside the water dock. It is proposed to run pipe lines farther out into the stream for the accommodation of larger vessels, but no work has been done on this (July, 1918). There are no dry docks, floating docks, etc., at this port. There are many small craft stowed about the harbor, most of which are badly in need of repairs. Among them are 2 large dredges, 2 floating cranes (perhaps 10 tons capacity), 5 pile drivers, about 15 tugs of various types, 6 or 7 motor boats of 30 to 40 feet, etc. (For type of crane, see illustration 22.)

Repair shops.—Repair facilities are limited to work which may be done on the repair ship *Casania*. The ship contains a bench-work compartment, a foundry, blacksmith shop, carpenter shop, machine shop, and various tool rooms and supply and equipment rooms. In the machine shop were observed the following machines by actual count (July, 1918): Ten lathes, capable of taking lengths of about 12 to 14 feet; 1 slotting machine, 1 planer, 2 milling machines, 1 gear cutter, 3 drilling presses, 1 wall planer, 1 center grinder, 2 emery wheels, and 1 laying-off table. The bench room was found equipped with about 10 vises for small work. In the foundry were two cupolas capable of handling castings of approximately 600 pounds. The blacksmith shop contained 7 small hand forges, and just outside was a steam hammer, capable of making forgings of possibly 1,000 pounds. The carpenter shop was equipped with several work benches and numerous small hand tools. The

Miles. Versts.

workmen appear very skillful and capable of turning out first-class work. Practically the only shops on shore where any repair work could be undertaken are a few small blacksmith shops. One of these was observed to contain a lathe, capable of handling lengths of about 12 feet, a small drilling machine, and a couple of hand forges, and a variety of hand tools usually found in a shop of this character. Others contained a small forge or two with various hand tools.

Terminals.—The station has a yard of sidetracks, sidings near the depot and for storehouses, and a water supply for locomotives. There is also approximately 1,500,000 square feet of open space for cargoes unloaded from the steamers. There are five or six tracks leading along the water front and connecting with the piers. The roundhouse is a temporary wooden building with a locomotive shop for small repairs. Water for the use of locomotives is taken from artificial pools built on the station grounds. At last reports there were several hundred cars of all kinds lying idle on the tracks, and usually from 20 to 30 engines.

Electric-light plant.—The plant is built on the station grounds and contains a 120 k.w.a., 50-cycle, 220-volt, 3-phase, alternating-current generator, driven by a 2-cylinder oil engine. A steam-driven plant is being installed which will have a capacity of 600 kw.

Labor.—Most of the laborers are those who were sent here when the town was first started, to which have been added soldiers and sailors since the revolution. The employees are not inclined to work, with the exception of the railroad men. Wages

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are very high compared with former conditions—10 to 20 rubles a day instead of 2 or 3. All work done is under orders of various committees with the authority of the "Soviet."

Provisions and supplies.—There is no business section in the town, and at latest reports no shops for public trade. Practically no provisions or supplies can be obtained. Such supplies as exist are under the control of the "Soviet," and only issued by it on signed permits. No grain or vegetables are produced in the vicinity, and what supply of food is on hand was left over from the revolution. Supplies for the allies are shipped by steamers. The British steamer *Nigeria* has been converted into a refrigerating ship and keeps a reserve supply of meat and vegetables. The refrigerating plant has a capacity of about 200 tons of meat. Two old ships *Katanga* and *Laureston* are used as coal hulks, and at last reports kept about 3,000 tons of coal in reserve (July, 1918).

Communications.—There is not a single road leading into the country from Murmansk. In summer communication with Alexandrovsk is entirely by water. In winter traveling is by reindeer. From March to October there is weekly communication by steamer with Archangel, and in winter a steamer runs once a month from Alexandrovsk to Vardö and the Murman coast settlements. There is telegraph communication to Petrograd and other places along the railroad line, and a wireless station near Alexandrovsk of low power and little use. There is a wireless at Archangel on the White Sea, and at Rovaniemi, Sodankyla, and Enare, in Finland. Mail is irregular and entirely

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dependent upon the arrival of steamers. Mail to the interior of the country is by special courier only.

Water.—It is proposed to carry water for the use of the city from the lakes in the hills by gravity. The pipes have not been laid, and at present water for dwellings is procured from wells only 5 to 10 feet deep. Water here as elsewhere should be boiled for drinking.

Time.—The time originally was two hours ahead of Greenwich time, but, beginning June 5, the time was set ahead two hours further, making it four hours ahead of Greenwich time.

On leaving the station of Murmansk the railroad runs so close to the shore of the inlet that in some places the embankment goes as far as the tide line on the beach. It is protected with solid-stone dams. There are a number of cuts in the soft soil, mostly worked out with spades. The line follows the curves of the inlet on the right-hand side, and on the left the hills rise 200 to 300 feet from the road.

6 9 Kola.—

Station.—The station has sidetracks for sorting trains, and the construction of houses and barracks for railroad employees has already been started. It was planned at one time to have the main locomotive depots and machine shops here in the future. There is a large flat on the east side of the river available for this purpose. This is said to be also suited for the landing of aeroplanes. The valley is perhaps 1,250 feet wide.

Village of Kola is located on the opposite side of the Kola River, near its junction with the

Miles. Versts.

Tuloma River. It had a population of about 650 before the construction of the railroad, since when it has increased. Transportation was by means of dogs, there being only two horses in the village when the railroad came. There is a large church here. (See illustration 23.)

The railroad, after leaving Kola station, follows close to the shore of the Kola River. (See illustrations 24 and 25. On the opposite shore lies the Mountain Solevarka. The line cuts through rock, and about 2 miles from the station of Kola crosses the river on a bridge 245 feet in length, and continues south on the west bank of the river. The bridge is a temporary one, constructed on wooden piles, with 30-foot spans of iron girders. It was partly destroyed by high water in the spring of 1917. The foundations for stone piers for a permanent structure were ready when the revolution stopped work. The line continues south in the valley of the Kola, the hills rising 150 to 200 feet beside the line. All the way along they are covered with stunted pine. The embankment at times is so close to the water that it is saved from destruction only by a stone abutment. At verst 23 the river is noted as being very rapid, with heavy boulders along bottom and sides. The valley is exceedingly narrow. About 12 miles south of Kola the river is 250 feet wide and not very rapid. In 1917 ice froze 15 feet thick, which was much thicker than usual. At verst 40 is a timber water tank.

28 42 **Loparskaya** has three sidetracks, a double water equipment, a few dwellings, and some barracks.

At about 55 versts the line crosses the river to the east side, and for 31 miles passes by Lakes

Miles. Versts.

Murdozero and Kolozero. The country continues about the same, valleys and hills covered with timber, much burned in places. Timber on the east side heavier than on the west. At verst 60 is a bridge 145 feet long. All sand along here, and an excellent borrow pit. A mile farther much disintegrated granite gravel appears. At verst 68 the line leaves the Kola River, which at that point is a very swift stream about 40 feet wide. The valley is still very narrow and the mountains rise rapidly on the west. The country is covered with drift.

46 70 Pulozero.—Timber water tank. Country is swampy or sand and gravel, with woods. (See illustration 26.)

At verst 75 line crosses a lake on a long bridge with rock crib piers and short timber spans. At verst 90 road passes down a valley.

69 105 Olenya.—Same type of station as Loparskaya. The country has the same character as the Kola River Valley—low hills covered with rare pine trees. The soil is of sand mixed with glacial boulders. The swamps are shallow.

The line next passes by Lake Imandra, which is a very large lake with many islands, its outlet flowing into the White Sea. It is 70 feet deep and very stormy in autumn. The lake lies in the main mountain range of the Kola Peninsula, known as the Chibinsky Mountains, which rise about 3,600 feet on the east. The western are about 1,000 to 1,500 feet lower, growing higher as they trend northwestward toward Norway. The Laplanders camp on the Chibinsky highlands in summer with their reindeer. The line passes at the foot of

Miles. Versts.

these mountains, crossing many rivers which rise in the glaciers above. The lower ridges of the mountains are covered with pine woods, but higher up they are entirely bare. On the west toward the lake the land is open and snow shields are necessary to protect the line in winter. Not far from Imandra the line crosses one of the bays of the lake. There are some swamps along here, but the country is mostly mountain débris and cemented sand. At verst 111 there is a village on the lake shore. At verst 120 it is all sand and there is a borrow pit for hand shovels. At verst 133 another pole line comes in carrying four wires. The railway line here has five wires.

91 137 Imandra.—The station has four tracks and a double water equipment. Water station is just south of depot. There are barracks for employees and a timber roundhouse, with three stalls, accommodating six locomotives. There is no town and only the station buildings. Country is mostly sand with some drift, and there are fewer marshes than are found a little farther south.

The line continues near the shore of Lake Imandra, cutting through ridges of the Chibinsky Mountains. The mountains are described as "hanging over" the lake, but with an intervening space of 1 to 2 miles. The railroad crosses them on a wide pass at 809 feet elevation. The ground is mostly sand with a base of solid rock. On the left hand are fine spruce woods and on the right open country. At verst 144 is a timber bridge at a fill. Verst 156, a sawmill and one siding on east and one on left. Also a borrow pit.

Miles. Versts.

122 184 **Tikozero.**—The station has two tracks with double water equipment and barracks for employees.

From this point the line leaves the lake, continues southwest, winding between large swamps. The country gradually changes into a flat plain, with many large marshes, covered with small trees and brush, but no woods. The line runs through this country for about 20 miles and again touches the shore of Lake Imandra, where the River Niva rises. It crosses this river, on a bridge 875 feet long, about 20 miles north of the village of Kandalaksha. The bridge is constructed of low wooden supports with 21-foot iron spans. A ballast pit is located about one-half mile to the west at verst 219. A timber water tank and two sidings, one on east and one on west, are found at verst 220. At verst 227 there is one siding on the east of track, and two timber water tanks on south bank of the Niva. The banks of the river are high. (See illustration 27.) The timber is rather good, both in the valley and on the mountains. There are four wires on the east and five on the west along here.

151 230 **Niva** has three tracks and a water supply. A branch line connects with the tiny village of Šashiek on the shore of Lake Imandra, where piers were constructed and used while the railway was being built.

Leaving Niva the line starts on level, peaty ground, but rises and follows the bank of the River Niva as far as Kandalaksha. At first it runs almost at water level and passes several lakes, through which the river flows, but the river becomes more rapid and near Kandalaksha flows in a deep valley through woods.

Miles. Versts.

171 258 **Kandalaksha.**—This station is on elevated ground and has five sidetracks and several houses for officials. It is about 200 miles from Archangel, across the White Sea, and there is good communication in winter over that sea when frozen. The following routes lead into Finland: 1. Partly by water and partly by trail to Allakurti, 60 miles west. Thence to Sallatunturi (85 miles southwest of Kandalaksha), and Kemtrisk, to Rovaniemi. The road is good from Kemtrisk to Rovaniemi. Rovaniemi is 190 miles west by south of Kandalaksha on one of the Finnish railways. 2. To Kuusamo, 125 miles southwest of Kandalaksha, by trail, thence to Uleaborg on the Gulf of Bothnia by a good road. 3. By lakes via Rugozaskaya, 55 miles southwest of Kandalaksha, and thence to Uleaborg. (For these routes and the possibility of German railway building, see introduction under communications.)

Kandalaksha Harbor.—This is a village of about 100 houses, situated at the head of Kandalaksha Bay at the end of a branch line, 2 miles from Kandalaksha. There are some good dwellings for railroad officials. The town is situated on the lake just where the River Niva empties into it. The Niva is very swift and said to be a good salmon stream. The hills rise on all sides. On one of them, close to the village, stands an old church with a belfry. The port has docking facilities, even at low tide, for large ships drawing 26 feet of water. The pier has a track and crane, and the harbor is provided with storehouses. Buildings and barracks would house 2,000 men. There is a main locomotive depot and locomotive shops in a temporary wooden building. (See illustrations

files. Versts.

28-30.) Building of permanent stone structure was stopped by the revolution. The wooden engine shed has two stalls and holds four engines. The depot has running water, and the shops can make small repairs; 3 lathes, 1 wheel lathe, 2 shapers, and 3 presses were reported there in August, 1917.

Leaving the station of Kandalaksha the line runs along the western shore of the White Sea. It crosses many mountain streams and gradually descends until it reaches the level of the shore. It crosses a gulf for about 2 miles on a long stone dam, near which on the shore are barracks for workmen and several storehouses. At one time these barracks housed 3,000 people. The line continues along the southern, sandy shore of the gulf, passing the small village of Fedosyevka. There are houses and barracks for workmen here. The line next runs through woods in which are many small lakes among the rocky hills. There are many curves. The country becomes more mountainous, covered with forests and underbrush. Frequent glimpses are had of Kandalaksha Bay on the left. At verst 275 the line is in the hills. There is one siding on the east here and a big sand pit. Poles on west side of line carry four wires. The timber is good, mostly Norway pine, jack pine, and some good birch. From verst 284 all the way to Soroka it is reported to be one continuous swamp in summer. At verst 286 track has one siding on the east, and at verst 294 is a double timber water tank across two tracks. The depot is high up on the hill to the east.

Zhemchuznaya.—The station has three tracks with a water supply and dwelling houses.

Miles. Versts.

The railroad continues near the shore until the next station.

198 300 Knyazhaya Guba—Knyazhaya Guba Harbor.—The harbor is located about $2\frac{2}{3}$ miles from the station. At the end of the branch line there is a pier with about 24 feet of water. The village is said to contain 50 houses. Rails and other material were unloaded here at the time of the construction of the railroad. (See illustration 32.)

In the section between Knyazhaya Guba station and Kovda the railroad passes near Lake Surjac, the shore of which it follows until it crosses the two rivers—the big and little Kovda—at about verst 330. These two rivers flow at a short distance from each other and are the source for the whole system of lakes extending as far as the White Sea. The northern one has very heavy rapids. Both are spanned by wooden bridges of a simple type of construction.

218 330 Kovda.—The station has three tracks, water supply, barracks, and houses for officials. The water supply is a double one, consisting of two pumping stations and two water towers. The engine can be brought close to the water tower by means of sidetracks and filled directly. It takes about five to seven minutes to fill the tender. The village (about 65 houses) lies on the east bank of the Kovda River where it enters a gulf. It is full of rapids here and about 200 yards wide. There is a large sawmill here.

Beyond Kovda the line enters a more level country, still covered with woods. At verst 347 is a siding on the east, and another on the east at verst 353.

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234 354 **Polyarni Krug.**—The station has a roundhouse for 12 locomotives, extra sidings near the depot and a wye. In August, 1917, it was reported that there was a forge here. A good hospital is situated on the edge of a slope. The other buildings, which include houses and barracks, are higher up on the mountain overlooking the station, and having a fine view of the surrounding country.

The line now proceeds toward the western end of Chupa Bay, which is 25 miles long and $1\frac{1}{4}$ miles wide, with a fairway depth of 32 feet. At verst 366 is a very fair gravel pit one-fourth mile to the east.

263 397 **Chupa.**—One siding on the east and one on the west. Near the station are workmen's barracks, which, together with the buildings at the port, should house 2,000 men. The port is situated about 2 miles from the station at the end of a branch line. The pier is laid with track and has a 20-ton crane. It is 250 feet long, will provide for two hatches, and has 24 feet of water on the north side. Near by on the shore are storehouses for food, grain, and other supplies, with cellars for preserving vegetables and ice houses for meat. There are dwellings for officials and workmen and a hospital. (See illustrations 33 and 34.)

From Chupa station the line runs south through woods, crossing the river Keret. (See illustrations 35 and 36.) At verst 404 is a borrow pit of good sand.

73 413 **Keret.**—The station has three sidings, with a water supply and houses for officials. The village of Keret (115 houses) lies in horseshoe form around the shores of a gulf at the foot of a long

Miles. Versts.

rapids in a stream which empties there. It contains a church, school, parish offices, and large sawmills. The village is an old one.

From Keret the road passes over a level surface of turf to Boyarskaya.

291 440 **Boyarskaya.**—The situation of the station is elevated and sandy. There are three sidings with water supply and houses.

For about 10 miles beyond the station the line runs at some elevation through thick pine forests. It then descends into a country with many marshes which have a growth of low shrubs. Woods are seen on the higher spots. The district is without inhabitants. The line approaches Lake Engozero.

310 469 **Engozero.**—The station is located on flat, peaty ground. It has four tracks, a double water equipment, temporary depots, and locomotive shops for small repairs. The wooden engine house has three stalls for five locomotives. In August, 1917, it was reported that the shop had 5 lathes, 2 presses, 5 forges, 2 shapers, 2 gap lathes, and 1 spring hammer.

Beyond the station the line runs along level ground between numerous marshes.

328 495 **Sig.**—The station has three tracks, a water supply, and houses for officials.

355 536 **Pongoma.**—The station has two tracks on the east, buildings, and water tanks. It is connected by a branch line with Pongoma Harbor, situated on the Pongoma Bay. The bay is deep and navigable, even at low tide, for ships drawing 24 feet. The pier is available for large ships and is built in a quiet place, well protected from winds and rough sea. The village contains about 30 houses.

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After leaving Pongoma station the line crosses a deep marsh, one-half mile in length and more than 30 feet deep. This is the worst marsh in the entire line, and it took six months, working day and night, to haul the sand for the fill. The road continues through level country and crosses the river Letnaya. At verst 538 is a bridge with big fills on each side. At verst 547 there is a siding on the south.

362 547 **Lyetneryetskaya.**—The station is located near the river and is of the usual type. The village, about 35 houses, is on the shore of the White Sea. From here to Kem the country is a continuous marsh. The earth necessary for filling had to be brought from $6\frac{1}{2}$ to $13\frac{1}{2}$ miles. The roadbed is now practically secure for its entire length, and no sinkings have been reported.

382 574 **Kem.**—The station is on the left bank of the river Kem near the town of the same name. It has facilities for coal and water, the latter handled by balanced buckets. On the other side of the main track is a three-stall wooden engine shed for six locomotives. It is badly open to the weather. Just west of this house are several short tracks, on one of which is a coal platform. There are also four or five other frame buildings on the station grounds, including depot and storehouses. The yards are ample, with many sidetracks. The telegraph poles running north carry four wires. The hills here are long and from 50 to 100 feet high. The town has a population of about 3,500. It is the administrative and educational center of the western White Sea coast region. The population of the Kem district is about 50,000, about

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half of whom are Karelians. The town contains postal and telegraph offices, the customs and frontier offices, as well as the department of local administration, a national school, a city school, as well as others of inferior character, and many stores. (See illustrations 38-41.) The famous Solovetsky monastery, on the island of the same name, is a few hours' sail in the White Sea. (See illustration 42.)

It was reported (July 26, 1918) that the Germans had built a wagon road from Kem via Kianta (Suomussalmi) to Kajana (head of one of the Finnish railways). The route used before led by river and lake about 100 miles west to Ukhta, from which point there was a good road to Kianta (about 55 miles west by south of Ukhta) via Puolanka and Utajarvi to Uleaborg. There are also houses for officials.

Kem Harbor.—Kem Harbor is on a branch line, 8 miles long, on the shore of the White Sea, near the mouth of the Kem River. It is one of the best natural harbors on the White Sea, well protected by a range of islands. It remains unfrozen longer than other bays. A new breakwater has been built, with accommodations for large steamers and with a depth of water from 28 to 32 feet. It is supplied with tracks and a 20-ton crane. Work was begun on additional wharves, but interrupted by the revolution. There is a large sawmill here.

Beyond Kem station the line crosses the river on a bridge 784 feet long. (See illustrations 43 and 44.) The current is very swift and the river is not frozen in winter. About 8 miles upstream from this bridge is a famous waterfall, "Pdoujensky,"

Miles. Versts.

22 feet high. After crossing the river the line passes through a rock cut, and then for a long distance over the marshes, which extend as far as Soroka. The descent to the River Shouja, through a deep cut, had to be worked out of the swamp, which is a very unusual condition. This river is spanned by a bridge 420 feet long. The line, which is very crooked, continues along the bank of the river until the next station is reached. There are very large granite quarries in this section. The timber is small and scarce.

Shuyeretskaya.—The station is on the opposite side of the river from the village of the same name, which has about 170 houses, some of two or three stories. The inhabitants are expert fishermen and sail as far as Norway. (See illustration 45.)

Beyond the station the line often approaches the shore of the White Sea, which is low and peaty. About $6\frac{2}{3}$ miles before reaching the station of Soroka it enters a region of large swamps, surrounding on all sides the village of Sorvik. At verst 598 there is one siding east and one west, on a gravel ridge. Very little timber here.

19 630 **Soroka.**—

Description.—A large village of about 250 houses on the shore of the White Sea, at the mouth of the River Vig. (See illustration 46.) It has been known in history since the twelfth century, and its population is pure Russian from old Novgorod. They are chiefly occupied in fishing and hunting. The population in the Soroka district is very sparse. The villages consist of only two or three houses and are often from 10 to 20 miles apart. Shipbuilding is carried on. There is a large saw-

Miles. Versts.

mill. The wood is mostly pine of good quality. In the winter the people cut timber and bring it to the river banks, floating it down in summer to the sawmills on the shore of the White Sea, or taking it on sledges to the large sawmills at Lieksa, on the Finnish Railway. The town is situated on a mossy plain in the middle of rocky hills. Nearby there is nothing but turf and stone, and the sand and earth necessary for railway construction had to be brought some distance from the south.

Station.—The station is large, with a main locomotive house, spacious warehouses, dwellings, and barracks for the workmen, a hospital and dispensary. There is a wye, the water tower being located at its apex. The main depot is provided with tracks and switches, warehouses, and locomotive shops for small repairs. In August, 1917, the shop was reported to have three lathes, two wheel lathes, one emery wheel, one press, eight forges, one shaper, one gap lathe, and one spring hammer. The lathes are run by moveable power stations. There is electric light. The telegraph poles carry five wires north.

Harbor and piers.—Soroka has a newly constructed pier 165 feet long, but the harbor is not convenient, as excavation is not completed. (See illustration 47.) About 7 miles north, at Ras-Navolok (name of village and bay), there is also a pier with deep water, taking steamers of 24-foot draft. In July, 1918, this was reported as under construction. Both this pier and the one at Soroka have railway tracks.

Communications.—North: There is no road going north for any wheeled vehicles.

East: To the east there is one very bad one leading to the village of Suma, about 30 miles to

Miles. Versts.

the southeast, around the south shore of the White Sea. From this point there are two roads, one continuing east to the station Obozerskaya, on the Archangel-Vologda Railroad. This road is very bad and is impassable in summer. The trip takes three days and horses may be obtained en route in the villages. There is also communication in the summer between Soroka and Archangel by steamer.

South: The only road south is the very poor one leading to Suma, whence a good one goes south to Povenetz, on the north shore of Lake Onega, paralleling the railway on the east, which it again joins at Medvyezhy-Gora, west of Povenetz.

West: In summer the country to the west toward the Finnish frontier is absolutely impassable. It is possible in winter to go from Soroka to Lieksa (a station on the Finnish Railroad running north from Lake Ladoga). Travel is by sledge and takes $4\frac{1}{2}$ days and nights. Even in January the road must be carefully chosen, as the water is apt to be rising over the ice, which is weighted down with snow. There is a road part of the way. The villages usually consist of three or four houses each, being 15 miles apart. There may be one or two horses in each village.

From Soroka the railroad line continues south, passing through swamps for 6 miles. The grade then rises and the line approaches the river Vig, following its left bank for about 50 miles. The whole region is flat, with some vegetation in dry places and small fir trees in the swamps. Near the river Idel the swamps are particularly large. The whole district for many miles is covered with

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water in spring, the railroad bed alone remaining above the surface. The embankment is made of stone and sand and is perfectly safe. The bridges are wood. At verst 643 there is one siding on the east and one on the west.

461 696 **Parandovskoye.**—The line gives frequent glimpses on the east of the river Vig and approaches the famous Nadvoitzky waterfalls, of 25,000 horsepower. The river Vig is deep but unsuitable for navigation on account of many rapids. The line next crosses the river Onda, a tributary of the Vig, on a bridge of 5 spans, 70 feet each. (See illustration 48.) The river Segezha, which connects Lakes Viga and Sega, is crossed by a wooden bridge of 6 spans, 70 feet each, about 74 miles south of Soroka. Both of these bridges are always guarded, as their destruction would mean long interruption of travel. South of Onda the country is covered with thick evergreen woods, which continue to Petrozavodsk.

475 732 **Segezha.**—

506 765 **Urosozero.**—For about 10 miles beyond verst 821 the country is sandy, covered with drift and small granite boulders. The vegetation is a low growth of jack pine.

549 830 **Maselskaya.**—At this station the line crosses the watershed between the Baltic and White Seas at an elevation of 560 feet. The station has a roundhouse, 3 sidings on the west, 2 timber water tanks, a dwelling for officials, and barracks for workingmen. (For general type of workmen's barracks, see illustration 49.) In August, 1917, the shop was said to contain 1 press, 1 bolt cutter, and 1 gap lathe. It is located on a sandy flat near

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the lake. The surrounding country is wooded. A branch line $2\frac{1}{2}$ miles leads to Segozero Harbor.

Leaving Maselskaya the line runs into a country of hills and rocks and descends to the left bank of the river Kumsa, crossing the river on a bridge 150 feet long. (See illustration 50.)

558 843 Medvyezha Gora.—The station has a round-house and a branch to a dock on the lake, where are facilities for unloading six barges at once. There are cultivated fields and kitchen gardens in the neighborhood, and barley, corn, potatoes, and turnips are raised. The surrounding country is more thickly settled than farther north, there being about 10 villages not far away. At 10 miles to the east is the town of Povenetz.

One of the possible lines of attack by the enemy might be from Joonsu, on the Finnish Railway, via Keskyarvi and Marussuri, across country to the railroad line near this station. Good roads lead from here to Povenetz and also north to the White Sea at Suma. (See above, under Soroka.) There is another good road running closely parallel to the railroad to the next station, Petrozavodsk, where it divides. One branch runs southwest to Olonetz, near Lake Ladoga, where it again divides, one road running along the north shore to Sardavala and the other along the south shore to Petrograd. The other road from Petrozavodsk runs southeast around the south end of Lake Onega to the Archangel-Vologda Railroad, which it reaches at Plesetskaya. After leaving the station the line climbs higher along the shore of Lake Onega, passing through forests. At verst 850 there is a siding on the east.

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576 870 **Kyapeselga.**—There are two wooden water stations here. The road now descends with numerous curves among rocky hills and mountain ridges to the shore at Kondopoga Harbor. The country abounds in glacial boulders, weighing from 1 to 12 tons.

Lizhma.—

Kivach.—At verst 878 there is one siding on the east, at verst 898 one on the east and one on the west; also, at the latter point, two timber water tanks with direct-acting pumps. At verst 902 the line crosses a swift-running stream. At the south end of the bridge is a timber water tank. At verst 905 there is a siding on the east. The country here is hilly. At verst 912 is another siding on the east and a little village of 20 houses on a small pond. The country begins to grow flatter, with sandy clay soil and swamps.

614 927 **Kondopoga.**—A branch line, 1 mile long, runs to the pier at the water front. The dock is suitable for sea steamers and barges.

From this station south the country is more flat and more thickly populated. Timber is white birch and spruce. At verst 931 is one siding on the east. Some big Norway pine here and gray birch. A little farther on (verst 935) the country is reported brushy, Verst 938, one siding east; verst 945, one on east and two timber water tanks; versts 946 and 953, one siding east; verst 964, one on east and one on west.

Suna.—The line crosses the River Suna on a wooden bridge, near which the water never freezes on account of the swiftness of the current. Eighteen miles upstream is the famous waterfall

Miles. Versts.

"Kivach," the largest in northern Russia. Preliminary work on a factory for explosives was started there, material being gathered and the main building begun, when work was stopped. South of the river the country becomes more open, with less woods and many cultivated fields.

627 964 Shuiski.—The River Shuya is crossed on a wooden bridge 336 feet long. The current is sluggish and the river freezes in winter. Near the bridge on the shore of the river is located the big village of Shuiski. The chief occupations of the inhabitants are agriculture, cattle herding, and fishing. Just after leaving Shuiski the line, for about 2 miles, passes a big hay marsh on the east. From here to Petrozavodsk the country is flat, with no woods. The population all along the section from Medveyelzhi-Gora to Petrozavodsk is Russian or Russianized Karelian. They are a prosperous and enterprising commercial people.

652 986 Petrozavodsk.—

Station and equipment.—The head office of the Murman Railway is at this place, with operating control of the whole line from Murmansk to Zvanka. The station has a 70-foot turntable and a system of extra tracks, with tracks leading to the locomotive house and warehouses. The former is built of reinforced concrete and is well equipped and electric lighted. It has 8 stalls and will house at least 20 engines. Near it is the largest and best equipped locomotive shop on the line. In August, 1917, the shop was reported to have 5 lathes, 1 wheel lathe, 2 presses, 1 miller, and 4 forges. The power is supplied by a 30 horsepower locomobile (Marshall, Gainsboro—English, No. 10258). It was

Miles. Versts.

intended to build a central locomotive shop here for big repairs for the whole line, and the whole shop, with full equipment, lathes, and power station, was bought and is reported ready in England, but has not been shipped. This shop would be necessary for working the line, as the distance is so great to any other. If, during the war, Petrozavodsk should not be a suitable location for the plant, it could be erected at Murmansk. During the transportation period of 1916-17 the shop at Vologda was used (one of the largest and best in Russia). The water supply is from Lake Onega, the water being piped to the depot and track cocks. The water tower has a tank and is fed by two 6-inch mains from station on the lake shore. The pumping station has two Russian pumps worked by a belt drive from two Swedish oil engines. There are buildings for a doctor's dwelling, hospital, and barracks for workmen, including dining halls, kitchen, baths, and laundries, with special room for disinfecting clothes with steam and formaline. There are also houses for about 80 officials. About 2,000 workmen can be cared for. The other operating officials live in the town.

Town of Petrozavodsk.—It is located about $1\frac{1}{2}$ miles from the railway, on the elevated shore of Lake Onega. It was founded in 1703 and is the capital of the Government of Olonetz. It has a population of about 35,000, and 12 factories with an annual output of 2,000,000 rubles, among them a munition plant, where shells were made during the war. The streets are fairly wide and paved with cobblestones. The principal ones seem to be the Sobornaya, which ascends from the harbor to the

Miles. Versts.

town, and the Marinskaya. There is a good-sized park.

Supplies.—Some agricultural products are raised locally by the peasants in small fields, but flour, grain, barley, and other products are imported from Ribinsk on the Volga, or Petrograd by the water route.

Horses.—Horses are easily obtainable in this district. There is a natural hay which grows in places where the river overflows, and this is cut and stored by the peasants during the summer.

Communications.—

1. Roads: There is, first, a good one leading north, parallel to the railroad to Medvyeizhi Gora, and Suma (about 30 miles southeast of Soroka, on the White Sea); a second one running southwest to Olonetz, where it divides, one branch following the north shore of Lake Ladoga, to Sardaval; and the other the south shore to Petrograd, with a short branch road running to Lodeinoye Polye, on the railway line. A third road runs southeast around the southern end of Lake Onega and connects with Archangel-Vologda Railway at Plesetskaya.

2. Water routes: These routes are only open in summer.

(a) Route to Petrograd: Steamer connection to Petrograd under normal conditions takes 35 hours going west and 45 hours east. The route is from the Bay of Petrozavodsk to Voznesenie at the beginning of the Onega Canal (6 to 8 hours), thence along the Zvir River past Gag-Rutchei, Myatusovo, Vazhini, Lodeinoye Polye to Sermaks, where the Zvir enters Lake Ladoga (133 miles from Voznesenie). In midsummer the river is obstructed in

Miles. Versts.

places by rapids. At Sermaks the boat enters Lake Ladoga, and a canal (along the south shore of the lake) leads to Schlüsselburg. From there the boat follows the river Neva to Petrograd.

(b) Route to Rybinsk: Route is through Lake Onega to Voznesenie, and thence by the Marinsky Canals and River Sheksna to Rybinsk on the Volga (440 miles).

(c) Route to Vologda: Route is through Lake Onego to Voznesenie and the canal system of the Grand Duke of Würtemberg (295 miles).

There is thus water communication with Petrograd on the west and with all the towns along the northern Dvina and Volga on the east. Navigation on Lake Onega is open from May until October, inclusive.

At verst 987 is one siding on the east and one on the west; also one on the west at verst 997. At this point there is much glacial drift and a big sand pit. There is a siding east and one west at versts 1007 and 1017, respectively.

675 1,020 **Pyazheva Selga.**—Eight wires are reported going north at verst 1024. There is also one siding on the east and one on the west here.

682 1,033 **Ladva.**—

697 1,053 **Tokari.**—A big sand pit about one-fourth mile to the east. At verst 1059, large water tank and two sidings on east. Hillsides on the east are cultivated. Verst 1068, swamps and low hills. Timber is rather thin, mostly pine and some white birch. Verst 1072, high ground to the west, perhaps 100 feet at one-half mile away. Verst 1073, two sidings on west. Timber water supply, with small pipe from spring. Not good in winter. Bor-

Miles. Versts.

row pit of sand. Verst 1082, one siding on east. There is a timber bridge here, with water barrels at one end. Country is clayey. Verst 1085, country sandy clay with jack pine and small white birch.

719 1,086 Zvir.—It would be possible to move German troops from Finland to the Murman Railway at this point by boat from the Finnish port of Sardaval on the north shore of Lake Ladoga. Possession of the Zvir River would give the enemy control of the southern end of the railway and also of the wagon road from Lodeinoye Polye to the Archangel-Vologda Railway. (See Lodeinoye Polye under Communications.) It has been reported that barges and motor boats were being collected at Sardaval and at Kexholm, another Finnish port on the western shore of the lake. The village is on the water route from Petrozavodsk to Petrograd. (See Petrozavodsk.)

At verst 1087 are three sidings on west. Verst 1093, line crosses the Zvir River; borrow pit about halfway down the hill. Some cultivation in surrounding country. Verst 1095, one siding on west. Verst 1096, line goes over the pass. River Zvir seen to the north. Country going down to the river is all clay. Some very heavy clay cuts on this section with a good deal of glacial drift. Verst 1100, country grows more sandy, with less timber. Verst 1103, one siding on west and a timber water tank. Several small farms to the east. Verst 1113, much lower country toward the east. Timber is pine with a few white birch. Verst 1115, one siding on west; country is somewhat peaty, with sandy knolls.

Miles. Versts.

745 1,126 Lodeinoye Polye.—

Town.—Population estimated at 10,000. The town is about one-half mile from the station and 100 feet lower, on level ground by the River Zvir. The surrounding country is flat and low, covered with small pine and birch.

Station.—The station has a carpenter shop of wood, 30 by 60. Main engine house is of reinforced concrete and has a turntable and eight stalls. There is a second wooden one of two stalls for three engines each. The back shop is concrete. There are also a blacksmith shop, joiner shop, sheet-iron working and wooden car repair shop. In August, 1917, there were reported 5 lathes, 1 wheel lathe, 4 presses, 1 miller, 2 shapers, 2 bolt cutters, 3 gap lathes, 2 planers, and 5 forges. Opposite the station is a convenient space of open ground about 700 by 250 yards.

Communication.—Roads lead in three directions: 1. There is a good one running east via Vytegra to Plesetskaya on the Archangel-Vologda line. Horses are obtainable and automobiles can be used. 2. A good road runs northwest to Olonetz and the shore of Lake Ladoga, which it follows to Sardavala. A branch runs north to Petrozavdsk. 3. A good road runs southwest, south of Lake Ladoga, to Petrograd.

After leaving Lodeinoye Polye the country is sandy with jack pine, or clayey with peat swamps. At verst 1146 is a small steel bridge. Verst 1152, country is all sand with jack pine. Verst 1154, one siding on west. At verst 1163 the country is flat and low with very little timber. A large monastery is located at verst 1165, about one-eighth of a mile.

Miles. Versts.

west of railway, on the river bank. Verst 1166, country still sandy with jack pine; one siding on east and one on west. About one-half mile before reaching Pazha line crosses a slough on a steel bridge.

777 1,174 **Pasha.**—This is a village of about 12 houses. The station has two sidings, water supply, and cranes. The country is very flat and mainly sandy clay. Verst 1196, one siding on west. Country growing lower and still less timber. A small town to the west. The line crosses the Pasha River on a steel bridge of three spans. The valley is all sand, with jack pine.

302 1,212 **Kolchanovo.**—One siding on west. Along this part of the line right-of-way fences have been put up, apparently by the farmers. Verst 1220, soil is clay of light red color. Some cleared land is planted with grain. There is a steel bridge over the river. Verst 1221, one siding on east, one on west. Country is mostly level, especially toward the west. Verst 1236, country very low and wet. Soil is peaty. Timber, white birch and small pine. The line crosses the River Volkhov just before reaching Zvanka.

19 1,237 **Zvanka.**—The line here joins the Vologda-Petrograd line, running west from Siberia. A branch line of 8 miles runs to Gastinapolyl, a harbor on the Volkhov River. There is a new turntable here, a 12-stall brick locomotive house, and a shop with a fine set of tools. The building was 30 by 60, and in August, 1917, an addition 30 by 30 feet was being built. There are 11 tracks on south and 2 on north.

46 1,278 **Voibokala.**

Miles. Versts.

861	1,300	Naziya.
873	1,318	Mga.
887	1,340	Sapernaya.
894	1,350	Rybatskoye.
		Obukhovo.
905	1,364	Petrograd.

THE RUSSIAN ALPHABET.

Russian letters.	English equivalents used in this volume.	Russian letters.	English equivalents used in this volume.
1. А а	A a.	19. С с	S s.
2. Б б	B b.	20. Т т	T t.
3. В в	V v.	21. У у	U u.
4. Г г	G g.	22. Ф ф	Ph ph, F f.
5. Д д	D d.	23. Х х	Kh kh.
6. Е е	E e, Ye, ye.	24. Ц ц	Ts ts.
7. Ж ж	Zh zh.	25. Ч ч	Ch ch.
8. З з	Z z.	26. Ш ш	Sh sh.
9. И и	I i.	27. Щ щ	Shch shch.
10. І і	I i.	28. Ъ ъ	(hard sign).
11. Ы ы	I i.	29. Ь ь	Y y.
12. К к	K k.	30. Ъ ъ	(soft sign).
13. Л л	L l.	31. Ъ ъ	Ye ye.
14. М м	M m.	32. Э э	E e.
15. Н н	N n.	33. Ю ю	Yu yu.
16. О о	O o.	34. Я я	Ya ya.
17. П п	P p.	35. Ё ё	Th th, F f.
18. Р р	R r.		

PRONUNCIATION.

Russian is practically a phonetic language; it is pronounced almost as it is written.

Vowels.—There are two sets of similar vowels in Russian, each having 5 letters:

(1) а, э, і, о, у, pronounced (as in Italian).

ah, eh, ee, o, oo.

(2) The same five sounds preceded by у: я, е, и, ё, ю.
pronounced yah, yeh, yee, yo, yu.

The two dots over *ë* (pronounced *yo*) are generally omitted in printing Russian. Therefore the occurrence of the sound “*yo*” can only be learned by ear, as in *Cherno-zyom*, “black earth”; *Beryoza*, “birch”; *Semyonov*.

In addition to these 10 vowels there are certain others:

(a) *ѣ* (called *yat*) is also pronounced *yeh*.

(b) *ы*, pronounced something like a very short *uh -ee*, has no equivalent in English. It is transliterated *y*.

(c) *ѣ* has the sound of a short *i*, something like *ih*.

There are no diphthongs in Russian; each vowel is sounded separately. Thus *Naumovka* is pronounced *Nah-oomovka*; *Troitski* is pronounced *Tro-itski*; *Bolshoi* is pronounced *Bolsho-i*.

Consonants.—Russian largely borrowed its alphabet from Greek. In modern Greek, the second letter, “beta,” has become “veta,” with the sound of *v*. Russian has preserved both sounds; therefore *b* and *v*, pronounced as in English, stand together as second and third in the Russian alphabet.

г and *д* (*g* and *d*) follow, taken in that order from Greek; *g* is always hard, as in *go* (see exception 2, below).

ж has the sound of “*je*” or “*ge*” in French, or of “*si*” in English words like “*occasion*,” “*persuasion*.”

з, к, л, м, н, п, с, т have the sounds of

z, k, l, m, n, p, r, s, t in English.

ф like an English “*f*” or “*ph*.”

ѳ (a child counts “one, two, *free*.” A Russian, taking words containing “theta” (*th*) from Greek, does the same)—

Theophanes becomes, in Russian, *Feofan*.

х a guttural *h*, like *ch* in the Scotch loch.

ц “*ts*,” as in “*its*.”

ч “*ch*,” as in “*church*.”

ш “*sh*,” as in “*wish*.”

щ “*sh-ch*,” as in “*British church*.”

ъ (hard sign, formerly *o*) hardens the consonant after which it is placed; thus *-ov* with the hard sign, at the end of a name, has the sound “*-off*.”

ь (soft sign, formerly e) after a consonant, has something the sound of y; its true effect can only be learned by ear.

Exceptions.—There are very few exceptions to the normal sounds of the Russian letters; two should be noted:

(1) Unaccented (unstressed) “o” has the sound of a very short “a”; thus Dostoyevski is pronounced Dastayèvski; Tolstoi is pronounced Talstòi.

(2) In the genitive singular, masculine and neuter, of pronouns and adjectives, aro, ero, oro, the g is pronounced as a “v”—avo, yevo, ovo.

Accent or stress.—In French the accent or stress generally falls on the last syllable; in Italian, on the syllable before the last (penult). In Russian there is no general rule. The accent, or stress, is, therefore, a main difficulty in Russian. As it is not marked in Russian printing, it can only be learned by ear. In the lists of place names in this book the syllable accented or stressed is marked with a grave accent (`).

Division of syllables.—In English, the syllable generally ends with a consonant; thus the syllables of the word “generosity” are gen-er-os-it-y.

In French, on the contrary, the syllable generally ends with a vowel; thus the syllables of the word “générosité” are gé-né-ro-si-té.

Failure to observe this rule is a distinctive mark of “English-French” and “American-French.”

Russian divides the syllables like French, not like English. Thus the syllables of Yekaterinoslav are Ye-ka-te-ri-no-slav.

Once the simple, normal sounds of the letters are learned, attention to the correct division of the syllables will do more than any one thing to make pronunciation correct and therefore intelligible.

Transliteration.

Foreign names should be restored, not retransliterated. Thus: New York, not Nyu Iork; John, not Dzhon.

1. For E write Ye at the beginning of words and after a vowel and the soft sign; thus write Yenisei, not Enisei; Tsarskoye, not Tsarskoe.

2. For Dzh, write J, as in Jankoi, Jalinda.

3. Use Ph in well-known names derived from Greek, as Philipovskoe.

4. Use Th in well-known names derived from Greek, as Theodosia, pronounced Feodosia.

ENGLISH.	PRONUNCIATION.	RUSSIAN.
1. TRAVEL.		
Where is —?	Gdyèh?	Гдѣ?
Where does this road lead?	Koo-dà ve-dyòt èh-ta do-rò-ga?..	Куда ведетъ эта дорога?
Which is the way to —?	Ko-tò-ra-ya do-rò-ga ve-dyòt v —?	Которая дорога ведетъ въ —?
Show me the way.	Po-ka-zhèè-tyeh mnyeh do-rò-goo.	Покажите мнѣ дорогу.
Is the road good?	Do-rò-ga kho-ròsh-aya?.....	Дорога хорошая?
How far is it?	Kak da-lye-kò?	Какъ далеко?.
How long will it take to go to —?	Skòl-ko vrè-me-nee zai-myòt dai-teè do —?	Сколько времени займетъ дойти до —?
Guide.....	Pro-vod-neèk	Проводникъ.
Straight ahead.....	Pryà-mo.....	Прямо.
East, eastward.....	Vos-tòk, na vos-tòk.....	Востокъ, на востокъ.
West, westward.....	Zà-pad, na zà-pad	Западъ, на западъ.
South, southward.....	Yuog, na yoog.....	Югъ, на югъ.
North, northward.....	Syèh-ver, na syèh-ver	Сѣверъ, на сѣверъ.
Left.....	Na lyèh-vo	На лѣво.
Right.....	Na prà-vo	На право.
When does the train start?	Kog-dà ot-khò-dit rò-yezd?.....	Когда отходитъ поѣздъ?
What place is this?	Ka-kò-eh èh-to myès-to?.....	Какое это мѣсто?
When shall we reach —?	Kog-dà mee do-yèh-dyem do —?	Когда мы доѣдемъ до —?
Motor boat.....	Mò-tor-na-ya lòd-ka.....	Моторная лодка.

ENGLISH.	PRONUNCIATION. NOTE.—Pronounce y as in “yet”; a as in “mast”; g as in “go”; ch as in “church.”	RUSSIAN.
TRAVEL—Continued.	POO-TEH-SHÈST-VEE- YEH—Continued.	ПУТЕШЕСТВИЕ—Прод.
Steamboat.....	Pa-ro-khòd.....	Пароходъ.
Barge.....	Bàr-zha.....	Баржа.
Raft.....	Plot.....	Плотъ.
Motor car.....	Af-to-mo-beèl.....	Автомобиль.
Tire.....	Shèè-na.....	Шина.
Gasolene.....	Pe-tròl.....	Петроль.
Wagon.....	Tel-yèh-ga.....	Телѣга.
Horses.....	Lò-sha-dee.....	Лошадь.
Harness the horses.....	Za-prya-gal-tyeh lo-sha-dyèh.....	Запрягайте лошадей.
Unharness the horses.....	Ras-prya-gal-tyeh lo-sha-dyèh.....	Распрягайте лошадей.
Feed the horses.....	Na-kor-mèè-tyeh lo-sha-dyèh.....	Накормите лошадей.
Bridle.....	Ooz-dà.....	Узда.
Reins.....	Vòz-zhee.....	Возжи.
Money.....	Dyèn-gee.....	Деньги.
How much?.....	Skòl-ko?.....	Сколько?
Too much.....	Slèè-shkom mnò-go.....	Слишкомъ много.
I will give.....	Ya dam.....	Я дамъ.
Telephone.....	Te-le-fòn.....	Телефонъ.
Telegraph.....	Te-le-gràf.....	Телеграфъ.
Wireless.....	Bez-prò-vo-loch-nih.....	Безпроводочный.

Locomotive.....	Lo-ko-mo-teef, pa-ro-vôz.....	Локомотивъ, паровозъ.
Freight car.....	To-vâr-ni va-gôn.....	Товарный вагонъ.
Passenger car.....	Pa-sa-zheër-skîh va-gôn.....	Пассажиръскій вагонъ.
Siding.....	Raz-yèzd.....	Разъѣздъ.
Railroad track.....	Zhel-yèz-na-ya do-rò-ga.....	Желѣзная дорога.
Track.....	Pol-lot-nò.....	Полотно.

2. TOPOGRAPHICAL TERMS. ТОПОГРАФИЧЕСКІЯ
 YA EE-MEH-NO-VA-NEE-YA. ИМЕНОВАНИЯ.

Map.....	Kàr-ta.....	Карта.
Stream.....	Roo-chèh-ih.....	Ручей.
River.....	Rye-kà.....	Рѣка.
Canal.....	Ka-nàl.....	Каналъ.
Swamp.....	Bo-lò-to.....	Болото.
Rapids.....	Beè-stree-na.....	Быстрина.
Ford.....	Brod.....	Бродъ.
Bridge.....	Most.....	Мостъ.
Road.....	Do-rò-ga.....	Дорога.
Street.....	Oò-lee-tsa.....	Улица.
Village.....	De-rèv-nya.....	Деревня.
Town.....	Gò-rod.....	Городъ.
Woods.....	Iye-sà.....	Лѣса.
Hills.....	Go-recè.....	Горы.
Mountain.....	Go-rà.....	Гора.
Valley.....	Do-lèè-na.....	Долина.
Plain.....	Rav-nèè-na.....	Равнина.
Lake.....	Ò-zeh-ro.....	Озеро.

ENGLISH.	PRONUNCIATION. NOTE.—Pronounce y as in “yet”; a as in “mast”; g as in “go”; ch as in “church.”	RUSSIAN.
3. MILITARY TERMS.	VO-YËN-NEE-YA EE-MEH- NO-VÀ-NEE-YA.	ВОЕННЫЯ ИМЕН- ОВАНЫЯ.
Soldier.....	Sol-dàt.....	Солдатъ.
Private.....	Rya-do-vò-ih.....	Рядовой.
Officer.....	O-fi-tsèr.....	Офицеръ.
Guard.....	Strà-zha, ka-ra-oòl.....	Стража, караулъ.
Sentry.....	Cha-so-vò-ih.....	Часовой.
Company.....	Rò-ta.....	Рота.
Regiment.....	Polk.....	Полкъ.
Rifle.....	Veen-tòv-ka.....	Винтовка.
Bayonet.....	Shteek.....	Штыкъ.
Revolver.....	Re-vòl-ver.....	Револьверъ.
Cartridge.....	Pa-tròn.....	Патронъ.
Gun.....	Roo-zhyò.....	Ружьё.
Shell.....	Sna-ryàd.....	Снарядъ.
Aeroplane.....	A-eh-ro-plàn.....	Аэропланъ.
Allies.....	So-yòòz-nee-kee.....	Союзники.
Enemy.....	Nyah-pree-yà-tel, vrag.....	Неприятель, врагъ.
Halt.....	Stò-ih.....	Стой.
Who goes there?.....	Ktò ee-dyòt?.....	Кто идетъ?
Countersign.....	Pa-ròl.....	Пароль.
Passport.....	Pàs-port.....	Паспортъ.

4. FOOD, UTENSILS, AND
SMOKING MATERIALS.

Food.....	Пища.....	ПИЩА, ПОСУДА, КУРИТЕЛЬНЫЯ МАТЕРІАЛЫ.
Bread.....	Khlyèb.....	Хлѣбъ.
Meat.....	Myà-so.....	Мясо.
Beef.....	Go-vyà-dee-na.....	Говядина.
Chicken.....	Tseep-lyò-nok.....	Цыпленокъ.
Mutton.....	Ba-rà-nee-na.....	Баранина.
Ham.....	Vet-chee-nà.....	Ветчина.
Eggs.....	Yàl-tsa.....	Яйца.
Vegetables.....	Ô-vosh-chee.....	Овощи.
Potatoes.....	Kar-tò-fe-lee.....	Картофели.
Fruit.....	Frook-tee.....	Фрукты.
Fish.....	Reè-ba.....	Рыба.
Butter.....	Mà-slo.....	Масло.
Cheese.....	Seer.....	Сыръ.
Milk.....	Mo-lo-kò.....	Молоко.
Coffee.....	Kò-fye.....	Кофе.
Tea.....	Chai.....	Чай.
Salt.....	Sol.....	Соль.
Pepper.....	Pyè-rets.....	Перецъ.
Sugar.....	Sà-khar.....	Сахаръ.
Ice.....	Lyod.....	Ледъ.
Brandy.....	Ko-nyàk.....	Коньякъ.
Boil.....	Va-reè-tye.....	Варите.

ENGLISH.	PRONUNCIATION. NOTE.—Pronounce y as in "yet"; a as in "mast"; g as in "go"; ch as in "church."	RUSSIAN.
FOOD, UTENSILS, AND SMOKING MATERI- ALS—Continued.	PEËSH-CHA, PO-SOÒ-DA, KOO- REE-TEL-NEE-YA MA-TEN- RYA-LEE—Continued.	ПИЩА ПОСУДА КУРИ- ТЕЛЬНЫЯ МАТЕРИ- АЛЫ—Продолжение
Stew.....	Too-sheè-tye.....	Тушите.
Bake.....	Is-pyeh-keè-tye.....	Испеките.
Glass.....	Sta-kàn.....	Стаканъ.
Cup.....	Chàsh-ka.....	Чашка.
Plate.....	Ta-ryèl-ka.....	Тарелка.
Knife.....	Nò-zhik.....	Ножикъ.
Fork.....	Veèl-ka.....	Вилка.
Spoon.....	Lòzh-ka.....	Ложка.
Saucepan.....	Sko-vo-ro-dà.....	Сковорода.
Kettle.....	Chai-nik.....	Чайникъ.
Breakfast.....	Oò-tren-nih chai, zàf-trak.....	Утренний чай, завтракъ.
Dinner.....	Ob-yèd.....	Обѣдъ.
Supper.....	Oò-zhin.....	Ужинъ.
Cigarettes.....	Pa-pee-rò-see.....	Папиросы.
Tobacco.....	Ta-bàk.....	Табакъ.
Pipe.....	Troòb-ka.....	Трубка.
Matches.....	Speèch-kee.....	Спички.
Fire.....	O-gòn.....	Огонь.

5. CLOTHING, BEDDING,
TOILET.O-DYE-VÁ-NEE-YEH, PO-
STYÉL-NY PRY-BÔR, TWA-
LET.

Clothes.....	O-dyèzh-da.....	Одежда.
Trousers.....	Bryòo-kee, shta-neè	Брюки, штаны.
Shirt.....	Roo-bàsh-ka	Рубашка.
Undershirt.....	So-ròch-ka	Сорочка.
Underdrawers.....	Pod-shtàn-nee-kee	Подштанники.
Socks.....	Nos-keè	Носки.
Boots.....	Sa-po-geè	Сапоги.
Shoes.....	Bo-teèn-kee	Ботинки.
Laces.....	Shnoor-keè	Шнуры.
Puttees.....	Gèh-tree, shtee-blèh-tee	Гетры (штиблеты).
Gloves.....	Per-chàt-kee	Перчатки.
Belt.....	Pò-yas	Пояс.
Button.....	Pòò-gov-ka	Пуговка.
Uniform.....	Moon-deèr	Мундиръ.
Overcoat.....	Pal-tò	Пальто.
Fur coat.....	Shòò-ba	Шуба.
Cap.....	Shàp-ka	Шапка.
Handkerchief.....	No-so-vò-i pla-tòk	Носовой платокъ.
Needle.....	Ee-gòl-ka	Иголка.
Thread.....	Neèt-kee	Нитки.
Pin.....	Boo-làv-ka	Булавка.
Blanket.....	O-dyeh-yà-lo	Одѣяло.
Pillow.....	Po-doòsh-ka	Подушка.

ОДѢВАНІЕ, ПОСТЕЛЬ-
НЫЙ ПРИБОРЪ
ТУАЛЕТЪ.

ENGLISH.	PRONUNCIATION.	RUSSIAN.
NOTE.—Pronounce y as in “yet”; a as in “mast”; g as in “go”; ch as in “church.”		
CLOTHING, BEDDING, TOILET—Continued.	O-DYÈ-VÀ-NEE-YEH, PO- STYÈL-NY PRI-BÒR, TWA- LÈT—Continued.	ОДѢВАНІЕ, ПОСТЕЛЬ- НЫЙ ПРИВОРЪ, ТУА- ЛЕТЪ—Прод.
Soap.....	Meè-lo	Мыло.
Towel.....	Po-lo-tyèn-tse.....	Полотенце.
Razor.....	Brit-va.....	Бритва.
6. ANIMALS.	ZHÈE-VÒT-NEE-YA.	ЖИВОТНЫЯ.
Horse.....	Lò-shad	Лошадь.
Cow.....	Ko-rò-va	Корова.
Sheep.....	Ov-tsà	Овца.
Dog.....	So-bà-ka.....	Собака.
Fish.....	Reè-ba	Рыба.
Reindeer.....	O-lyèn	Олень.
Duck.....	Oòt-ka	Утка.
Goose.....	Goos	Гусь.
7. TIME, SEASONS, AND WEATHER.	VRÈ-MYA, SE-ZÒ-NEE ÈÈ PO-GÒ-DA.	ВРЕМЯ, СЕЗОНЫ И ПОГОДА.
Sunday.....	Vos-kre-sè-nye.....	Воскресенье.
Monday.....	Po-nye-dyèl-nik	Понедѣльникъ.
Tuesday.....	Ftòr-nik.....	Вторникъ.
Wednesday.....	Srye-dà	Среда.

Thursday.....	Chet-vèrg.....	Четвергъ.
Friday.....	Pyat-nee-tsa.....	Пятница.
Saturday.....	Soob-bò-ta.....	Суббота.
January.....	Yan-vàr.....	Январь.
February.....	Fev-ràl.....	Февраль.
March.....	Mart.....	Мартъ.
April.....	A-preèl.....	Апрѣль.
May.....	Mai.....	Май.
June.....	I-yoon.....	Юнь.
July.....	I-yoòl.....	Юль.
August.....	Av-goost.....	Августъ.
September.....	Sen-tyà-br.....	Сентябрь.
October.....	Ok-tyà-br.....	Октябрь.
November.....	No-yà-br.....	Ноябрь.
December.....	De-kà-br.....	Декабрь.
Spring.....	Ves-nà.....	Весна.
Summer.....	Lyèh-to.....	Лѣто.
Autumn.....	Ô-syen.....	Осень.
Winter.....	Zee-mà.....	Зима.
What is the right time?.....	Ko-tò-rih chas?.....	Который часъ?
Please show me your watch.....	Po-zhà-loo-is-ta po-ka-zheè-tye mnyeh và-shée cha-seè.	Пожалуйста покажите мнѣ Ваши часы.
Day.....	Dyen.....	День.
Night.....	Noch.....	Ночь.
Morning.....	Oò-tro.....	Утро.
Afternoon.....	Pòl-dyen.....	Полдень.

ENGLISH.	PRONUNCIATION.	NOTE.—Pronounce y as in “yet”; a as in “mast”; g as in “go”; ch as in “church.”	RUSSIAN.
TIME, SEASONS, AND WEATHER—Continued.	VRÉ-MYA, SE-ZÒ-NEE EE PO-GÒ-DA—Continued.	ВРЕМЯ, СЕЗОНЫ И ПОГОДА—Продолжение.	
Early.....	Rà-no	Рано.	
Late.....	Pòz-dno	Поздно.	
Will it snow?	Boò-det lee snyèg?	Будетъ ли снѣгъ?	
Will it rain?	Boò-det lee dozhd?	Будетъ ли дождь?	
Will it storm?	Boò-det lee gro-zà	Будетъ ли гроза?	
Will there be a blizzard?	Boò-det lee me-tyèl?	Будетъ ли метель?	
Cold.....	Khò-lod-no	Холодно.	
Wet.....	Sèè-ro	Сыро.	
Dry.....	Soò-kho	Сухо.	
Warm.....	Tep-lò	Тепло.	
8. COLORS.	TSVE-TÀ.	ЦВѢТА.	
Red.....	Kràs-nih	Красный.	
White.....	Byèh-lih	Бѣлый.	
Blue.....	Sèè-nih	Синий.	
Light blue.....	Go-loo-bò-ih	Голубой.	
Black.....	Chòr-nih	Черный.	
Green.....	Ze-lyò-nih	Зеленый.	
Yellow.....	Zhòl-tih	Желтый.	
Brown.....	Ko-rèèch-ne-veeh	Коричневый.	

9. HOUSE AND FURNITURE.

DOM ЕЕ МЕН-БЕЛ.

ДОМЪ и МЕБЕЛЬ

House.....	Dom.....	Домъ.....
Tent.....	Pa-lât-ka.....	Палатка.....
Room.....	Kòm-na-ta.....	Комната.....
Door.....	Dver.....	Дверь.....
Wall.....	Stye-nà.....	Стѣна.....
Floor.....	Pol.....	Полъ.....
Roof.....	Krèè-sha.....	Крыша.....
Window.....	Ok-nò.....	Окно.....
Stove.....	Pyech.....	Печь.....
Chair.....	Stool.....	Стулъ.....
Table.....	Stol.....	Столъ.....
Bed.....	Kro-vàt.....	Кроватьъ.....
Lantern.....	Fo-nàr.....	Фонарь.....
Candle.....	Sve-chà.....	Свѣча.....

10. PERSONS.

LEE-TSA.

ЛИЦА.

Man.....	Moozh-cheè-na.....	Мужчина.....
Woman.....	Zhèn-shchee-na.....	Женщина.....
Child.....	Deetyà, re-byò-nok.....	Дитя, ребенокъ.....
Boy.....	Màl-chik.....	Мальчикъ.....
Little girl.....	Dyè-voch-ka.....	Дѣвочка.....
Girl.....	Dyè-vush-ka.....	Дѣвушка.....
Brother.....	Brat.....	Братъ.....
Sister.....	Ses-trà.....	Сестра.....
Husband.....	Moozh, soo-proòg.....	Мужъ, супругъ.....

ENGLISH.	PRONUNCIATION.	RUSSIAN.
NOTE.—Pronounce y as in "yet"; a as in "mast"; g as in "go"; ch as in "church."		
PERSONS—Continued.		
	LEË-TSA—Continued.	ЛИЦА—Продолженіе.
Wife.....	Zhe-nà, soo-prooga.....	Жена, супруга.
Father.....	Ot-yèts.....	Отецъ.
Mother.....	Mat.....	Мать.
Son.....	Seen.....	Сынъ.
Daughter.....	Doch.....	Дочь.
11. HUMAN BODY.		
	CHE-LO-VYË-CHES-KO-YE TYË-LO.	ЧЕЛОВѢЧЕСКОЕ ТѢЛО.
Head.....	Go-lo-và.....	Голова.
Face.....	Lee-tsò.....	Лицо.
Nose.....	Nos.....	Носъ.
Eyes.....	Gla-zà.....	Глаза.
Mouth.....	Rot.....	Ротъ.
Ears.....	Oò-shee.....	Уши.
Arm.....	Roo-kà.....	Рука.
Leg.....	No-gà.....	Нога.
Hand.....	Roo-kà.....	Рука.
Foot.....	No-gà.....	Нога.
Finger.....	Pà-lets.....	Палецъ.
Toes.....	Pàl-tsee na no-gàkh.....	Пальцы на ногахъ.

12. ADJECTIVES AND
ADVERBS.

PREE-LA-GÀ-TEL-NEE-YA,
EE NA-RYEH-CEE-YA.

ПРИЛАГАТЕЛЬНЫЕ и
НАРЪЧІЯ.

Big.....	Bol-shò-ih.....	Большой.
Little, a little.....	Mà-len-kih, nye-mnòzh-ko.....	Маленькій, немножко.
Good, well.....	Kho-rò-shih, kho-ro-shò.....	Хорошій, хорошо.
Bad, badly.....	Door-nò-ih, plo-khò-ih; doòr-no, plò-kho.	Дурной, плохой; дурно, плохо.
All, (same, feminine).....	Vsyò, vsyà.....	Все, вся.
None.....	Nee-ka-kò-ih.....	Никакой.
Some.....	Nyès-kol-ko.....	Нѣсколько.
Broad, broadly.....	Shi-rò-kih, shi-ro-kò.....	Широкій, широко.
Narrow, narrowly.....	Oòs-kih, Oòs-ko.....	Узкій, узко.
Clean, cleanly.....	Cheès-tih, cheès-to.....	Чистый, чисто.
Dirty, dirtily.....	Gryàz-nih, gryàz-no.....	Грязный, грязно.
Much.....	Mnò-go.....	Много.
Long, (same, adverb).....	Dleèn-nih, dleèn-no.....	Длинный, длинно.
Short, shortly.....	Ko-ròt-kih, kò-rot-ko.....	Короткій, коротко.
Light, lightly { (easy) } { (bright) }	{ Lyòkh-kih, lyekh-kò..... Svyèt-lih, svyet-lò.....	Легкій, легко.
		Свѣтлый, свѣтло.
Dark, darkly.....	Tyòm-nih, tem-nò.....	Темный, темно.
Quick, quickly.....	Beès-trih, skòrih; beès-tro, skò-ro.	Быстрый, скорый; быстро, скоро.
Slow, slowly.....	Mèd-len-nih, mèd-len-no.....	Медленный, медленно.
Thick, thickly.....	Tòl-stih, tòl-sto.....	Толстый, толсто.
Thin, thinly.....	Tòn-kih, tòn-ko.....	Тонкій, тонко.
Wet, (same, adverb).....	Mò-krih, mò-kro.....	Мокрый, мокро.

ENGLISH.	PRONUNCIATION. NOTE.—Pronounce y as in "yet"; a as in "mast"; g as in "go"; ch as in "church."	RUSSIAN.
ADJECTIVES AND AD- VERBS—Continued.	PREE-LA-GÀ-TEL-NEE-YA. EE NA-RYÈN-CÉE-YA—Continued.	ПРИЛАГАТЕЛЬНЫЕ И НАРѢЧІЯ—Прод.
Dry, drily.....	Soo-khò-ih, soò-kho.....	Сухой, сухо.
Few.....	Nyès-kol-ko.....	Нѣсколько.
First.....	Pyèr-vih.....	Первый.
Last.....	Pò-slyèd-nih.....	Послѣдній.
Old.....	Stà-rìh.....	Старый.
New.....	Nò-vih.....	Новый.
Open, openly.....	Ot-kreè-tih ot-kieè-to.....	Открытый, открыто.
Shut.....	Za-kreè-tih.....	Закрытый.
Strong, strongly.....	Seèl-nih, seel-no.....	Сильный, сильно.
13. VERBS AND PHRASES.	GLA-GÒ-LEE EE PHRÀ-ZEE.	ГЛАГОЛЫ И ФРАЗЫ.
I am.....	Yà.....	Я.
Thou art, you are.....	Tee, vee.....	Ты, Вы.
He is.....	On.....	Онъ.
She is.....	Onà.....	Она.
We are.....	Mee.....	Мы.
They are.....	O-nyèè.....	Они.

NOTE.—The present of the verb "to be" is omitted in Russian, the pronoun only being used.

I have.....	Ya ee-mèh-yoo	Я имѣю.
Thou hast, you have.....	Tee ee-mèh-yesh, vee ee-mèh-e-tye.	Ты имѣешь, Вы имѣете.
He has.....	On ee-mèh-yet.....	Онъ имѣетъ.
She has.....	O-nà ee-mèh-yet	Она имѣетъ.
We have.....	Mee ee-mèh-yem.....	Мы имѣемъ.
They have.....	O-nyee ee-mèh-yoot.....	Они имѣютъ.
I want.....	Ya kho-chod.....	Я хочу (мнѣ нужно).
Where is he?	Gdyèh on?.....	Гдѣ онъ?
Go.....	Ee-deè-tye	Идите.
Follow me.....	Ee-deè-tye za mnò-ih.....	Идите за мной.
Come (here).....	Ee-deè-tye (syoo-dà).....	Идите (сюда).
Stop.....	O-sta-no-veè-tyes	Остановитесь.
Please.....	Po-zhà-loo-is-ta.....	Пожалуйста.
Thank you.....	Bla-go-dàr-yoo vas.....	Влагодарю Васъ.
Do you understand?	Vee po-nyee-mà-ye-tye?.....	Вы понимаете?
Take this.....	Voz-meè-tye èh-to.....	Возьмите это.
Carry this.....	Nye-seè-tye èh-to.....	Несите это.
Wait.....	Po-dozh-deè-tye	Подождите.
I want food.....	Ya yest kho-chod.....	Я ѣсть хочу.
I want water.....	Ya kho-chod vò-doo.....	Я хочу воду.
Make a fire.....	Zazh-geè-tye o-gòn.....	Зажгите огонь.

ENGLISH.

PRONUNCIATION.

NOTE.—Pronounce y as in "yes"; a as in "mast"; g as in "go"; ch as in "church."

RUSSIAN.

NUMBERS.

NOO-ME-RÀ.

НУМЕРА

One, first.....	O-deèn, pèr-vy.....	Одинъ, первый.
Two, second.....	Dva, fto-rò-ih.....	Два, второй.
Three, third.....	T'ree, trè-tih.....	Три, третій.
Four, fourth.....	Che-teè-re, che-tvyòr-tih.....	Четыре, четвертый.
Five, fifth.....	Pyat, pyà-tih.....	Пять, пятый.
Six, sixth.....	Shes, shes-tò-ih.....	Шесть, шестой.
Seven, seventh.....	Sem, sed-mò-ih.....	Семь, седьмой.
Eight, eighth.....	Vò-sem, vos-mò-ih.....	Восемь, восьмой.
Nine, ninth.....	Dèh-vyat, deh-vyà-tih.....	Девять, девятый.
Ten, tenth.....	Dèh-syat, deh-syà-tih.....	Десять, десятый.
Eleven.....	O-deè-nad-tsat.....	Одинадцать.
Twelve.....	Dvye-nàd-tsat.....	Двѣнадцать.
Thirteen.....	T'ree-nàd-tsat.....	Тринадцать.
Fourteen.....	Che-tỳr-nad-tsat.....	Четырнадцать.
Fifteen.....	Pyat-nàd-tsat.....	Пятнадцать.
Sixteen.....	Shes-nàd-tsat.....	Шестнадцать.
Seventeen.....	Sem-nàd-tsat.....	Семнадцать.
Eighteen.....	Vò-sem-nàd-tsat.....	Восемнадцать.
Nineteen.....	Dèh-vyat-nàd-tsat.....	Девятнадцать.
Twenty.....	Dvād-tsat.....	Двадцать.

Thirty	Тридцать.....
Forty	Сорокъ.....
Fifty	Пятьдесятъ.....
Sixty	Шестьдесятъ.....
Seventy	Семьдесятъ.....
Eighty	Восемьдесятъ.....
Ninety	Девяносто.....
A hundred	Сто.....
A thousand	Тысяча.....

STANDARDS OF MEASURE.

RUSSIAN MONEY.

Under the old régime the gold ruble was equivalent to \$.5146, and the usual rate of exchange was about \$.51. During the revolution gold and silver disappeared entirely from circulation in Russia, even copper coins became very rare, and paper money declined greatly in value. In the summer of 1918 the ruble had an exchange value of only about \$.09. The paper rubles issued by the governments of Kerensky and Lenine were quoted at about \$.07 in some localities and were steadily declining.

Normally the Russian coins and their values are as follows:

The imperial, gold	\$7. 72
The 10-ruble piece	5. 14
The half imperial	3. 86
The 5-ruble piece	2. 57
1-ruble piece, silver	. 51
Half-ruble piece, silver	. 25
Quarter-ruble piece, silver	. 13
20-copeck piece	. 10
15-copeck piece	. 07
10-copeck piece	. 05

THE OLD RUSSIAN CALENDAR.

Until January 1, 1918, in all parts of Siberia and in Russia, except Finland, the Julian calendar, established by Julius Cæsar in 46 B. C., remained in force. This reckoning was 13 days behind the rest of Europe, which long ago adopted the Gregorian calendar. Thus, January 1 in Russia was really January 14. In many cases when Russians wrote dates they wrote both the Julian and the Gregorian date; for example, July 1/14, 1918. When dates in English publications are given according to the Julian calendar, the letters O. S. (old style) are appended. In

Russia there are many church holidays, which average about two days to the week.

CONVERSION OF VERSTS TO MILES.

[One verst=0.663 mile.]

No. of verts.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
.....	0.0	0.066	0.133	0.199	0.265	0.332	0.398	0.464	0.530	0.597
1.0..	0.663	0.729	0.796	0.862	0.928	0.995	1.061	1.127	1.193	1.260
2.0..	1.326	1.392	1.459	1.525	1.591	1.658	1.724	1.790	1.856	1.923
3.0..	1.989	2.055	2.122	2.188	2.254	2.321	2.387	2.453	2.520	2.586
4.0..	2.652	2.718	2.785	2.851	2.917	2.984	3.050	3.116	3.182	3.249
5.0..	3.315	3.381	3.448	3.514	3.580	3.647	3.713	3.779	3.845	3.922
6.0..	3.978	4.044	4.111	4.177	4.243	4.310	4.376	4.442	4.508	4.575
7.0..	4.641	4.707	4.774	4.840	4.906	4.973	5.039	5.105	5.171	5.238
8.0..	5.304	5.370	5.437	5.503	5.569	5.636	5.702	5.768	5.834	5.901
9.0..	5.967	6.033	6.100	6.166	6.232	6.299	6.365	6.431	6.497	6.564

Explanation.—In this table the left-hand column shows the number of versts in units, while the top line shows tenths of versts. The other columns show equivalents in miles. For instance, 8.6 versts equal 5.702 miles. With a little practice the conversion from miles to versts or versts to miles can be made with great rapidity.

Example No. 1—Versts into miles.—To convert 257 versts into miles:

At the point where the line marked 2.0 on the left intersects the column marked 0.5 at the top the figure 1.658 is found. This means that 2.5 versts equal 1.658 miles or that 250 miles equal 165.8 versts. Since seven more versts must now be added, we find the intersection of the line marked 7.0 and of the column

marked 0.0. There 4.641 miles appear as the equivalent of 7 versts. Hence 257 versts equal 165.8 miles plus 4.6 miles, or 170.4 miles.

Example No. 2—Miles into versts.—To convert 487 miles into versts:

In the figures denoting miles find the number nearest 487, disregarding the decimal point. This is 4.840 at the intersection of the line marked 7.0 and of the column marked 0.3. This means that 484 miles are equivalent to 730 versts. Since three more miles are needed to make 487, we find the number nearest to 3 among the mileage figures. This is 2.984 at the intersection of the line marked 4.0 and the column marked 0.5. This means that 2.984 miles, which are practically three miles, are equivalent of 4.5 versts. Therefore, 487 miles equals 730 versts plus 4.5, or 734.5 versts.

EXPLANATION OF CONVERSION TABLES.

In the following tables the column headed 1 shows how many units of the kind named second in each line are equivalent to one unit of the kind named first.

For example, in Table A an inch is equal to 1.1905 sotkas. The next column shows that 2 inches are equal to 2.3809 sotkas, while the column marked 9 shows that 9 inches are equal to 10.7143 sotkas. In similar fashion, 1 mile equals 1.50857 versts and 6 miles equals 9.05412 versts.

Suppose that we want to convert 962 miles into versts. We find in the table that 9 miles equals 13.5771 versts; 6 miles equals 9.05412 versts; 2 miles equals 3.01714 versts.

Therefore—

900 miles equals 1,357.71 versts.

60 miles equals 90.5412 versts.

2 miles equals 3.01714 versts.

962 miles equals 1,451.268 versts.

For reference purposes the following table of metric measures is added:

1 meter (m.)=100 centimeters (c. m.)=1,000 millimeters (m. m.).

1 kilometer (kil.)=1,000 meters.

Weight:

1 gram=100 centigrams.

1 kilogram=1,000 grams.

1 metric ton=1,000 kilograms.

Dry or liquid measures:

1 liter=100 centiliters=1,000 milliliters.

1 hectoliter=100 liters.

Conversion Table A.—LINEAR MEASURE.

GLISH TO RUSSIAN, RUSSIAN TO ENGLISH, METRIC TO RUSSIAN, AND RUSSIAN TO METRIC.

[1 duim=1 inch=10 linias or tochkas. The English inch and foot are sometimes used. 12 duims=1 foot; 1 arshene=16 vershoks=28 inches; 3 arshenes=1 sazhen; 100 sotkas=1 sazhen; 0.5 sazhens=1 verst.]

Multiplied by—	1	2	3	4	5	6	7	8	9
ENGLISH TO RUSSIAN.									
Inches to duims.....	1.1905	2.3809	3.5714	4.7619	5.9524	7.1428	8.3333	9.5238	10.7143
Inches to sotkas.....	.5714	1.1429	1.7143	2.2857	2.8571	3.4286	4.00	4.5714	5.1429
Inches to vershoks.....	.4286	.8571	1.2857	1.7143	2.1429	2.5714	3.00	3.4286	3.8571
Feet to arshenes.....	.1429	.2857	.4286	.5714	.7143	.8571	1.00	1.1328	1.2857
Feet to sazhens.....	1.5086	3.0171	4.5257	6.0343	7.5429	9.0541	10.56	12.0685	13.5771
Miles to vershs.....									
RUSSIAN TO ENGLISH.									
Duims to inches.....	0.84	1.68	2.52	3.36	4.20	5.04	5.88	6.72	7.56
Sotkas to inches.....	1.75	3.50	5.25	7.00	8.75	10.50	12.25	14.00	15.75
Vershoks to inches.....	2.3333	4.6666	7.00	9.3333	11.6666	14.00	16.3333	18.6666	21.00
Arshenes to feet.....	6.9999	13.9998	21.00	27.9999	34.9998	42.00	48.9999	55.9998	63.00
Sazhens to feet.....	.6629	1.3258	1.9886	2.6515	3.3144	3.9773	4.6402	5.3030	5.9659
Vershs to miles.....									
METRIC TO RUSSIAN.									
Centimeters to duims (in.).....	0.3937	0.7874	1.1811	1.5728	1.9685	2.3623	2.7560	3.1497	3.5434
Millimeters to sotkas.....	.0469	.0938	.1406	.1875	.2344	.2812	.3281	.3750	.4218
Centimeters to vershoks.....	.2250	.4500	.6749	.8999	1.1249	1.3498	1.5748	1.7998	2.0248
Meters to arshenes.....	1.4061	2.8122	4.2183	5.6244	7.0305	8.4366	9.8427	11.2488	12.6549
Meters to sazhens.....	.4687	.9374	1.4061	1.8748	2.3435	2.8122	3.2809	3.7496	4.2183
Kilometers to vershs.....	.9374	1.8748	2.8122	3.7496	4.6870	5.6244	6.5618	7.4992	8.4366
RUSSIAN TO METRIC.									
Duims (in.) to centimeters.....	2.5399	5.0798	7.5897	10.1596	12.6996	15.2395	17.7795	20.3194	22.8593
Sotkas to millimeters.....	.2134	.4267	.6401	.8534	1.0668	1.2801	1.4935	1.7069	1.9212
Vershoks to centimeters.....	4.4449	8.8898	13.3347	17.7797	22.2246	26.6695	31.1144	35.5593	40.0043
Arshenes to meters.....	.7112	1.4224	2.1336	2.8448	3.5559	4.2671	4.9783	5.6895	6.4007
Sazhens to meters.....	2.1336	4.2671	6.4007	8.5342	10.6678	12.8013	14.9349	17.0685	19.2026
Vershs to kilometers.....	1.0668	2.1336	3.2003	4.2671	5.3339	6.4007	7.4675	8.5342	9.6016

Conversion Table B.—SQUARE MEASURE.

ENGLISH TO RUSSIAN, RUSSIAN TO ENGLISH, METRIC TO RUSSIAN, AND RUSSIAN TO METRIC.

[3.0625 square duims = 1 square vershok; 784 square duims or 256 square vershoks = 1 square arshene; 9 square arshenes = 1 square sazhen = 2,304 square vershoks; 2,400 square sazhen = 1 dessiatine; 104½ dessiatines = 1 square verst = 250,000 square sazhen.]

Multiplied by—		1	2	3	4	5	6	7	8	9
ENGLISH TO RUSSIAN.										
Sq. in. to sq. duims.....			Note: 1 square inch = 1 square duim.							
Sq. in. to sq. vershoks.....		0.3265	0.6531	0.9796	1.3061	1.6327	1.9592	2.2857	2.6122	2.9388
Sq. ft. to sq. arshenes.....		.1837	.3673	.5510	.7347	.9181	1.1020	1.2857	1.4694	1.6531
Sq. ft. to sq. sazhen.....		.0204	.0408	.0613	.0816	.1020	.1224	.1429	.1633	.1837
Acres to dessiatines.....		.3704	.7408	1.1112	1.4816	1.8520	2.2224	2.5928	2.9632	3.3336
Sq. miles to sq. versts.....		2.2758	4.5516	6.8274	9.1031	11.3789	13.6547	15.9305	18.2063	20.4820
RUSSIAN TO ENGLISH.										
Sq. duims to sq. in.....		Note: 1 square duim = 1 square inch.								
Sq. vershoks to sq. in.....		3.0625	6.1250	9.1875	12.2500	15.3125	18.375	21.4375	24.500	27.5625
Sq. arshenes to sq. ft.....		5.4444	10.8888	16.3333	21.7777	27.2222	32.6666	38.1111	43.5555	49.0000
Sq. sazhen to sq. ft.....		48.9996	97.9992	146.9997	195.9993	244.9998	293.9994	342.9999	391.9995	441.0000
Dessiatines to acres.....		2.6997	5.3994	8.0992	10.7989	13.4986	16.1983	18.898	21.5978	24.2975
Sq. versts to sq. miles.....		.4394	.8788	1.3182	1.7576	2.1970	2.6364	3.0758	3.5152	3.9547
METRIC TO RUSSIAN.										
Sq. cm. to sq. duims.....		0.1550	0.3100	0.4650	0.6200	0.7750	0.9300	1.0850	1.2400	1.3950
Sq. cm. to sq. vershoks.....		.0506	.1012	.1518	.2025	.2531	.3037	.3543	.4049	.4555
Sq. m. to sq. arshenes.....		1.9771	3.9542	5.9313	7.9085	9.8856	11.8627	13.8398	15.8169	17.7940
Sq. m. to sq. sazhen.....		.2197	.4394	.6590	.8787	1.0984	1.3181	1.5377	1.7574	1.9771
Acres to sq. sazhen.....		21.9679	43.9359	65.9038	87.8718	109.839	131.807	153.775	175.743	197.711
Hectares to dessiatines.....		.9153	1.8307	2.7460	3.6613	4.5766	5.4920	6.4073	7.3226	8.2330
RUSSIAN TO METRIC.										
Sq. duims to sq. cm.....		6.4514	12.9027	19.3541	25.8055	32.2569	38.7082	45.1596	51.6110	58.0624
Sq. vershoks to sq. cm.....		19.7573	39.5147	59.2721	79.0295	98.7869	118.544	138.301	158.059	177.816
Sq. arshenes to sq. m.....		.5058	1.0116	1.5174	2.0231	2.5289	3.0347	3.5405	4.0463	4.5521
Sq. sazhen to sq. m.....		4.5521	9.1042	13.6562	18.2083	22.7604	27.3124	31.8645	36.4166	40.9687
Dessiatines to hectares.....		1.0925	2.1850	3.2775	4.3700	5.4625	6.5550	7.6475	8.7400	9.8325

N. B.—For land measures the principal metric unit is 1 are = 100 square meters or centiares; 100 ares = 1 hectare.

Conversion Table C.—CUBIC MEASURE.

ENGLISH TO RUSSIAN, RUSSIAN TO ENGLISH, METRIC TO RUSSIAN, AND RUSSIAN TO METRIC.

[5.359375 cubic duims = 1 cubic vershok; 21,952 cubic duims or 4,096 cubic vershoks = 1 cubic arshene; 27 cubic arshenes = 1 cubic sazhen.]

Multiplied by—	1	2	3	4	5	6	7	8	9
ENGLISH TO RUSSIAN.									
Cu. in. to cu. duims.....	Note: 1 cubic inch = 1 cubic duim.								
Cu. in. to cu. vershoks....	0.1866	0.3732	0.5598	0.7464	0.9329	1.1195	1.3061	1.4927	1.6793
Cu. ft. to cu. vershoks....	322.426	644.852	967.278	1,289.70	1,612.13	1,934.55	2,256.98	2,579.40	2,901.83
Cu. ft. to cu. arshenes.....	.0787	.1574	.2362	.3149	.3936	.4723	.5510	.6297	.7085
Cu. yds. to cu. sazhen.....	.0787	.1574	.2362	.3149	.3936	.4723	.5510	.6297	.7085
RUSSIAN TO ENGLISH.									
Cu. duims to cu. in.....	Note: 1 cubic duim = 1 cubic inch.								
Cu. vershoks to cu. in.....	5.3594	10.7187	16.0781	21.4375	26.7968	32.1562	37.5156	42.8750	48.2343
Cu. vershoks to cu. ft.....	.0372	.0744	.1117	.149	.1861	.2233	.2605	.2977	.3350
Cu. arshenes to cu. ft.....	12.7037	25.4074	38.1111	50.8148	63.5185	76.2222	88.9259	101.629	114.333
Cu. sazhen to cu. yds.....	12.7037	25.4074	38.1111	50.8148	63.5185	76.2222	88.9259	101.629	114.333
METRIC TO RUSSIAN.									
Cu. cm. to cu. d. ins.....	0.0610	0.1221	0.1831	0.2441	0.3051	0.3662	0.4272	0.4882	0.5492
Cu. cm. to cu. vershoks....	.0114	.0228	.0342	.0455	.0569	.0683	.0797	.0911	.1025
Cu. m. to cu. arshenes.....	2.7800	5.5600	8.3401	11.1201	13.9001	16.6801	19.4601	22.2402	25.0202
Cu. m. to cu. sazhen.....	.1030	.2059	.309	.4119	.5148	.6178	.7207	.8237	.9267
RUSSIAN TO METRIC.									
Cu. duims to cu. cm.....	16.3861	32.7723	49.1585	65.5446	81.9308	98.3170	114.703	131.089	147.475
Cu. vershoks to cu. cm.....	87.8196	175.639	263.459	351.278	439.098	526.918	614.737	702.557	790.377
Cu. arshenes to cu. m.....	.3597	.7194	1.0791	1.4388	1.7985	2.1582	2.5180	2.8777	3.2374
Cu. sazhen to cu. m.....	9.7122	19.4243	29.1364	38.8486	48.5607	58.2729	67.9850	77.6972	87.4093

Conversion Table D—LIQUID MEASURE.

RUSSIAN TO ENGLISH, ENGLISH TO RUSSIAN, METRIC TO RUSSIAN, AND RUSSIAN TO METRIC.

[Usual for commerce: (a) 1 butilka=1/20 vedro; 5 butilkas=1 chetvert; 4 chetverts=1 vedro; 40 vedros=1 bochka. (b) For wine measure only: 1 butilka=1/16 vedro; 4 b. tilkas=1 chetvert; 4 chetverts=1 vedro. This measure is not shown in the table below. Practically obsolete for commerce: 2 sarleeks=1 charka; 10 charkas=1 shloff; 10 shloffs=1 vedro.]

Multipled by—	1	2	3	4	5	6	7	8	9
ENGLISH TO RUSSIAN.									
Pints to butilkas.....	0. 9235	1. 8471	2. 7706	3. 6941	4. 6177	5. 5412	6. 4648	7. 3883	8. 3118
Pints to charkas.....	4. 6177	9. 2354	13. 8530	18. 4707	23. 0854	27. 7061	32. 3238	36. 9415	41. 5592
Quarts to chetverts.....	. 3694	. 7388	1. 10 3	1. 4777	1. 8471	2. 2165	2. 5859	2. 9553	3. 3247
Gallons to vedros.....	. 3694	. 7388	1. 1082	1. 4777	1. 8471	2. 2165	2. 5859	2. 9553	3. 3247
RUSSIAN TO ENGLISH.									
Butilkas to pints.....	1. 0828	2. 1656	3. 2484	4. 3312	5. 4140	6. 4968	7. 5795	8. 6623	9. 7451
Charkas to pints.....	. 2166	. 4331	. 6497	. 8662	1. 0828	1. 2994	1. 5159	1. 7325	1. 9490
Chetverts to quarts.....	2. 7070	5. 4140	8. 1209	10. 8279	13. 5349	16. 2418	18. 9488	21. 6558	24. 3628
Vedros to gallons.....	2. 7070	5. 4140	8. 1209	10. 8279	13. 5349	16. 2418	18. 9488	21. 6558	24. 3628
Bochkas to gallons.....	108. 279	216. 558	324. 837	433. 116	541. 396	649. 675	757. 954	866. 233	974. 512
METRIC TO RUSSIAN.									
Liters to butilkas.....	1. 6261	3. 2523	4. 8784	6. 5046	8. 1307	9. 7568	11. 3829	13. 0091	14. 6352
Liters to charkas.....	8. 1307	16. 2614	24. 3921	32. 5228	40. 6536	48. 7843	56. 9150	65. 0457	73. 1764
Liters to chetverts.....	. 3252	. 6505	. 9757	1. 3009	1. 6261	1. 9514	2. 2766	2. 6018	2. 9271
Liters to shloffs.....	. 8131	1. 6261	2. 4392	3. 2523	4. 0654	4. 8784	5. 6915	6. 5046	7. 3176
Liters to vedros.....	. 0813	. 1626	. 2439	. 3252	. 4065	. 4878	. 5692	. 6505	. 7318
Hectoliters to bochkas.....	. 2033	. 4065	. 6098	. 8131	1. 0163	1. 2196	1. 4229	1. 6261	1. 8294
RUSSIAN TO METRIC.									
Butilkas to liters.....	0. 6150	1. 2299	1. 8449	2. 4598	3. 0748	3. 6897	4. 3047	4. 9196	5. 5346
Charkas to liters.....	. 1230	. 2460	. 3690	. 4920	. 6150	. 7379	. 8609	. 9839	1. 1069
Chetverts to liters.....	3. 0748	6. 1495	9. 2243	12. 2990	15. 3738	18. 4485	21. 5233	24. 5981	27. 6728
Shloffs to liters.....	1. 2299	2. 4598	3. 6897	4. 9196	6. 1495	7. 3794	8. 6093	9. 8392	11. 0691
Vedros to liters.....	12. 299	24. 598	36. 897	49. 196	61. 495	73. 794	86. 093	98. 392	110. 691
Bochkas to hectoliters.....	4. 9196	9. 8392	14. 7588	19. 6784	24. 5981	29. 5177	34. 4373	39. 3569	44. 2765

N. B.—The common commercial liquid measures are the b. tilka, the chetvert, the vedro, and the bochka. For all purposes except wine measure, the b. tilka=1/20 vedro; b. til, as 1 butilka of wine=1/16 vedro, 4 b. tilkas of wine=1 chetvert. Generally in Russia small quantities of liquids other than intoxicants are sold at retail by weight (funts)—see Avoirdupois Table—but wholesale quantities are sold by liquid measure, 1 bochonok (small barrel)=36 English gallons.

Conversion Table E—DRY MEASURE.

ENGLISH TO RUSSIAN, RUSSIAN TO ENGLISH, METRIC TO RUSSIAN, AND RUSSIAN TO METRIC.

[3 garnets=1 chetverik; 8 chetveriks=1 chetvert.]

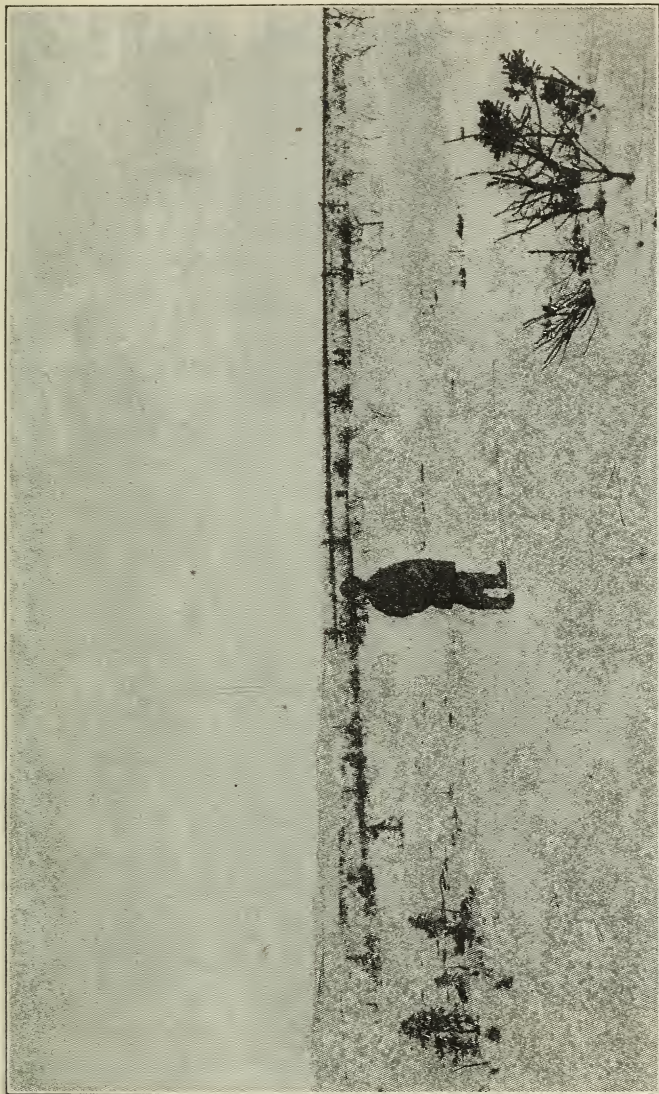
Multipled by—	1	2	3	4	5	6	7	8	9
ENGLISH TO RUSSIAN.									
Gallons to garnets.....	1.3853	2.7706	4.1559	5.5412	6.9265	8.3118	9.6971	11.082	12.467
Bushels to chetveriks.....	1.3853	2.7706	4.1559	5.5412	6.9265	8.3118	9.6971	11.082	12.467
Quarters to chetverts.....	1.3853	2.7706	4.1559	5.5412	6.9265	8.3118	9.6971	11.082	12.467
RUSSIAN TO ENGLISH.									
Garnets o gallons.....	.7219	1.4437	2.1656	2.8875	3.6093	4.3312	5.0530	5.7749	6.4968
Chetveriks to bushels.....	.7219	1.4437	2.1656	2.8875	3.6093	4.3312	5.0530	5.7749	6.4968
Chetverts to quarters.....	.7219	1.4437	2.1656	2.8875	3.6093	4.3312	5.0530	5.7749	6.4968
METRIC TO RUSSIAN.									
Liters to garnets.....	.3049	.6098	.9147	1.2196	1.5245	1.8294	2.1343	2.4392	2.7441
Hectoliters to chetverts....	.4764	.9528	1.4292	1.9056	2.3820	2.8584	3.3348	3.8112	4.2876
RUSSIAN TO METRIC.									
Garnets to liters.....	3.2798	6.5595	9.8393	13.1191	16.3988	19.6785	22.9583	26.2381	29.5178
Chetveriks to liters.....	26.2381	52.4762	78.7143	104.952	131.190	157.428	183.666	209.904	236.143
Chetverts to hectoliters....	2.0990	4.1981	6.2971	8.3962	10.4952	12.5943	14.6933	16.7924	18.8914

Conversion Table F—COMMERCIAL (AVOIRDUPOIS) WEIGHT.

ENGLISH TO RUSSIAN, RUSSIAN TO ENGLISH, METRIC TO RUSSIAN, AND RUSSIAN TO METRIC.
[96 dolyas=1 zolotnik; 3 zolotniks=1 lot; 32 lots=1 funt; 40 funts=1 pood; 10 poods=1 berkovei.]

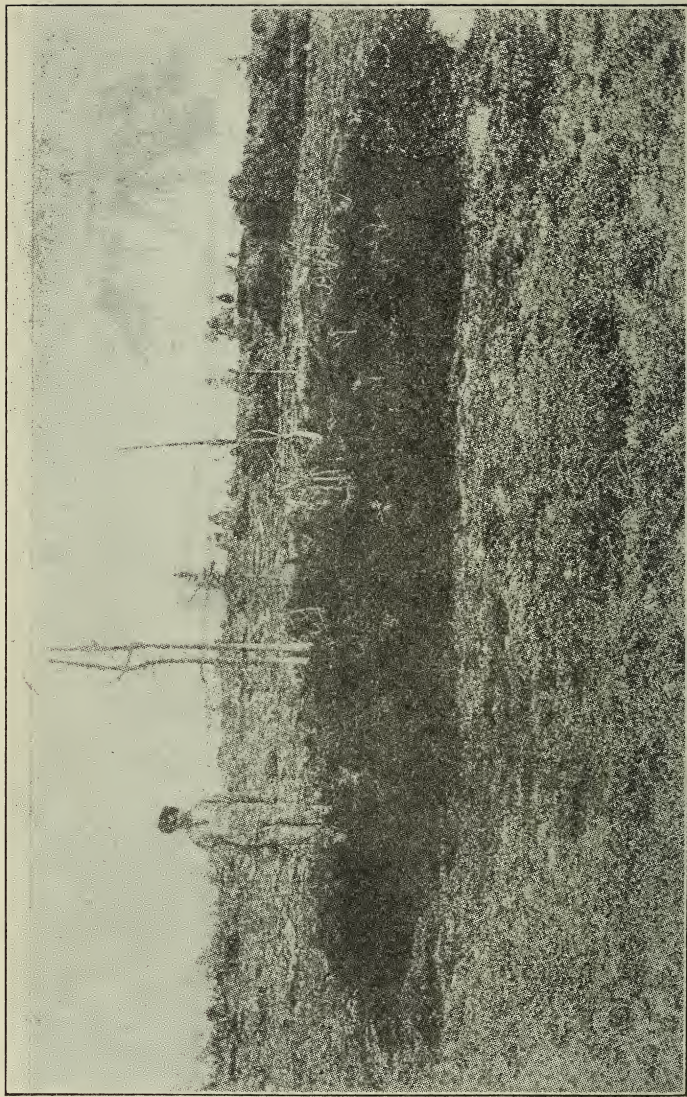
Multiplied by—		1	2	3	4	5	6	7	8	9
ENGLISH TO RUSSIAN.										
Ounces to zolotniks.....		6.6458	13.2916	19.9375	26.5833	33.2292	39.8750	46.5208	53.1667	59.8125
Ounces to lots.....		2.2153	4.4306	6.6458	8.8611	11.0764	13.2917	15.5070	17.7222	19.9375
Poun is to funts.....		1.1076	2.2153	3.3229	4.4306	5.5382	6.6458	7.7535	8.8611	9.9688
Poun is to poods.....		.0277	.0554	.0831	.1108	.1385	.1661	.1938	.2215	.2492
Tons (2,000 lbs.) to poods..		55.382	110.768	166.15	221.532	276.914	332.296	387.678	443.06	498.442
RUSSIAN TO ENGLISH.										
Zolotnik to ounces.....		.1505	.3009	.4514	.6019	.7523	.9028	1.0533	1.2037	1.3542
Lots to ounces.....		.4514	.9028	1.3542	1.8056	2.2571	2.7085	3.1599	3.6113	4.0627
Funts to poun is.....		.9028	1.8056	2.7085	3.6113	4.5141	5.4169	6.3197	7.2226	8.1254
Poods to poun is.....		36.1128	72.2256	108.338	144.451	180.564	216.676	252.789	288.902	325.015
Poods to tons (2,000 lbs.)..		.0181	.0361	.0542	.0722	.0903	.1083	.1264	.1445	.1625
METRIC TO RUSSIAN.										
Grams to zolotniks.....		.2344	.4688	.7033	.9377	1.1721	1.4066	1.6410	1.8754	2.1098
Grams to lots.....		.0781	.1563	.2344	.3126	.3907	.4689	.5470	.6251	.7033
Kilograms to funts.....		2.4419	4.8838	7.3258	9.7677	12.2096	14.6515	17.0935	19.5354	21.9773
Kilograms to poods.....		.0610	.1221	.1831	.2442	.3054	.3663	.4273	.4884	.5494
Tons (1,000 kg.) to berkoveis		6.1048	12.2096	18.3144	24.4192	30.5240	36.6289	42.7337	48.8385	54.9433
RUSSIAN TO METRIC.										
Zolotniks to grams.....		4.2658	8.5315	12.7972	17.0630	21.3288	25.5945	29.8603	34.1260	38.3918
Lots to grams.....		12.797	25.595	38.392	51.189	63.986	76.784	89.581	102.378	115.175
Funts to kilograms.....		.4095	.8190	1.2285	1.6381	2.0476	2.4571	2.8666	3.2761	3.6856
Poods to kilograms.....		16.3805	32.7610	49.1415	65.5220	81.9025	98.2830	114.663	131.044	147.424
Berkoveis to tons (1,000 kg.)		.1638	.3276	.4914	.6552	.8190	.9828	1.1467	1.3104	1.4742

N. B.—The smallest Russian weight is the dolya=4 4435 centigrams or 0 685736 grain. It is the same for commercial and apothecary weights (see table). For both weights there are 96 dolyas to 1 zolotnik. Polish weights are the same as Russian, with the exception that the centner and the korzec are used; 1 centner=100 pounds, and 1 korzec=216 pounds avoirdupois. Finnish weights are according to the metric system.



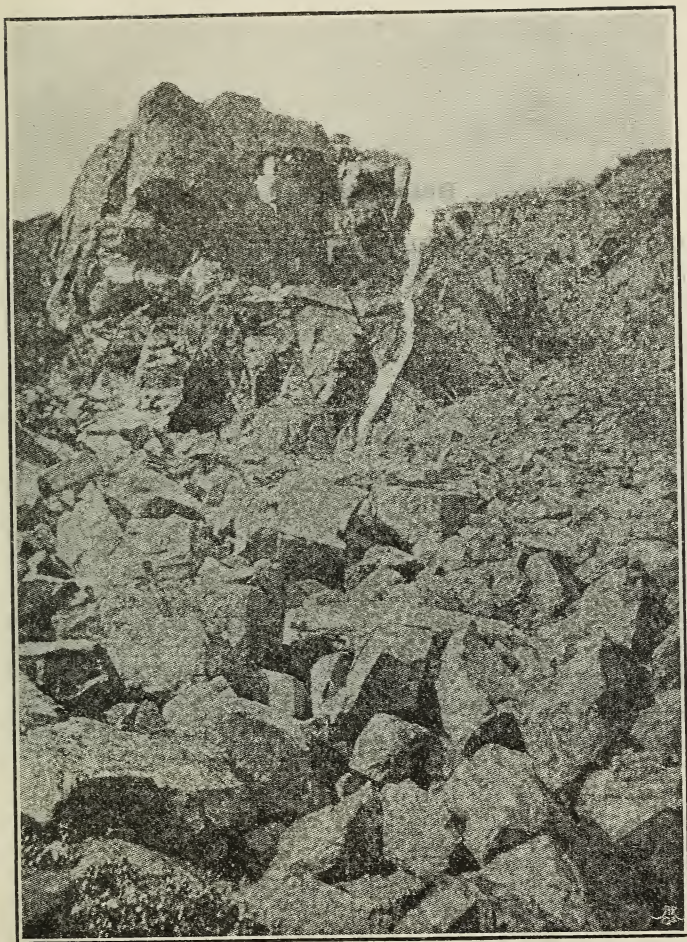
No. 1.—Tundra scene, showing scantiness of vegetation in north.

Russia. Route A.



No. 2.—Scene in Lugaururt, Chibinsky Mountains.

Russia. Route A.



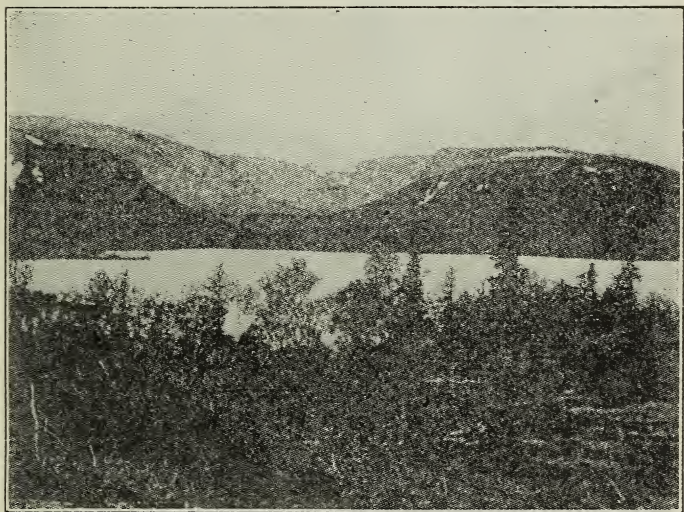
No. 3.—Scene in the Murman, showing type of much of that country.

Russia. Route A.



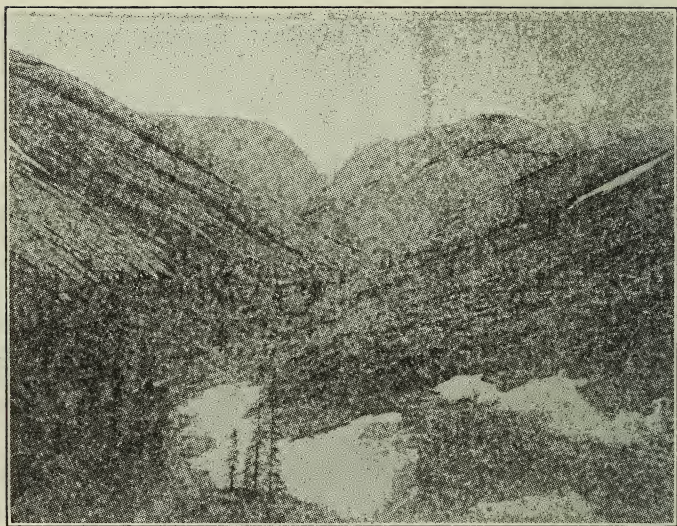
No. 4.—Boulder strewn country of the Murman.

Russia. Route A.



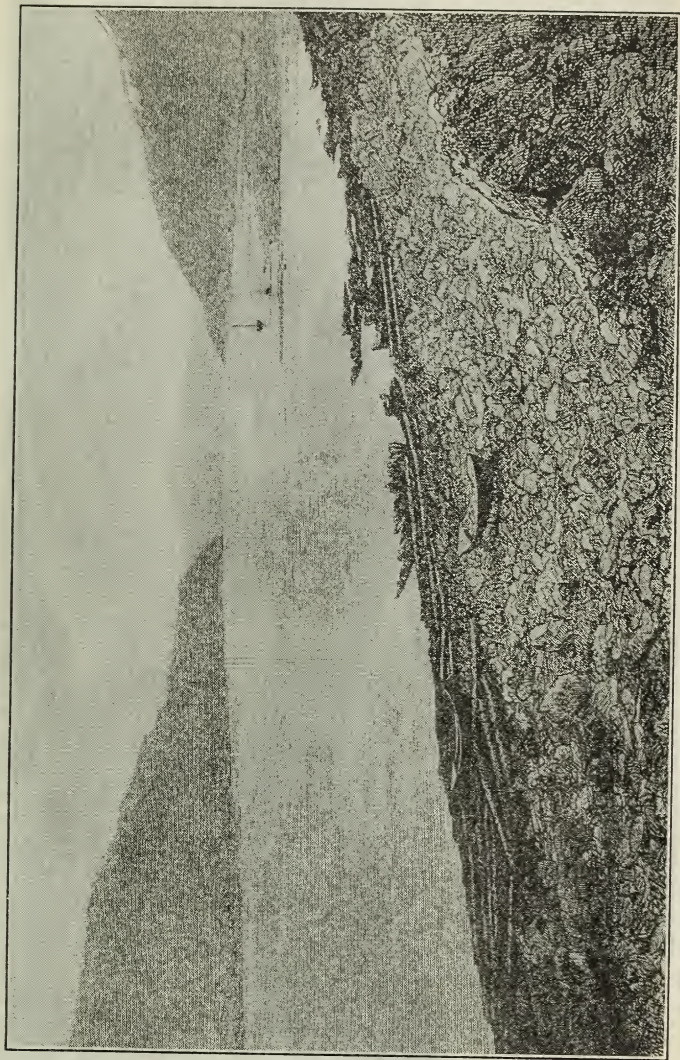
No. 5.—Lake Seitjaur in Chibinsky Mountains.

Russia. Route A.



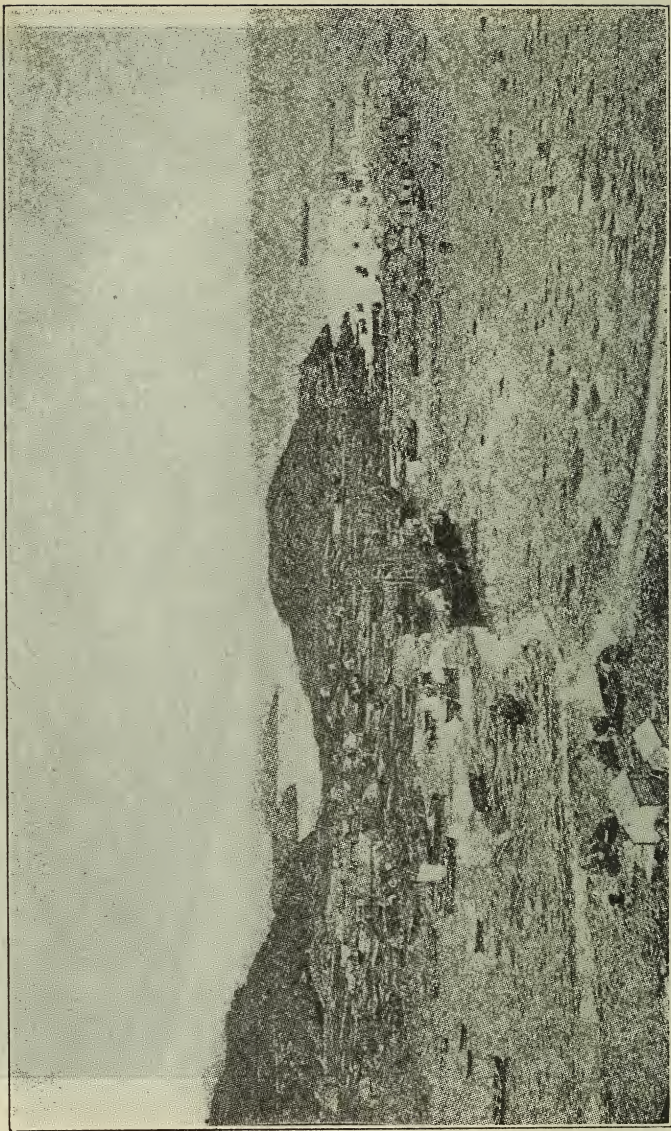
No. 6.—Scene in Umptek Highlands. Chibinsky Mountains.

Russia. Route A.



No. 7.—Scene on River Ponoi, eastern part of Kola Peninsula.

Russia. Route A.

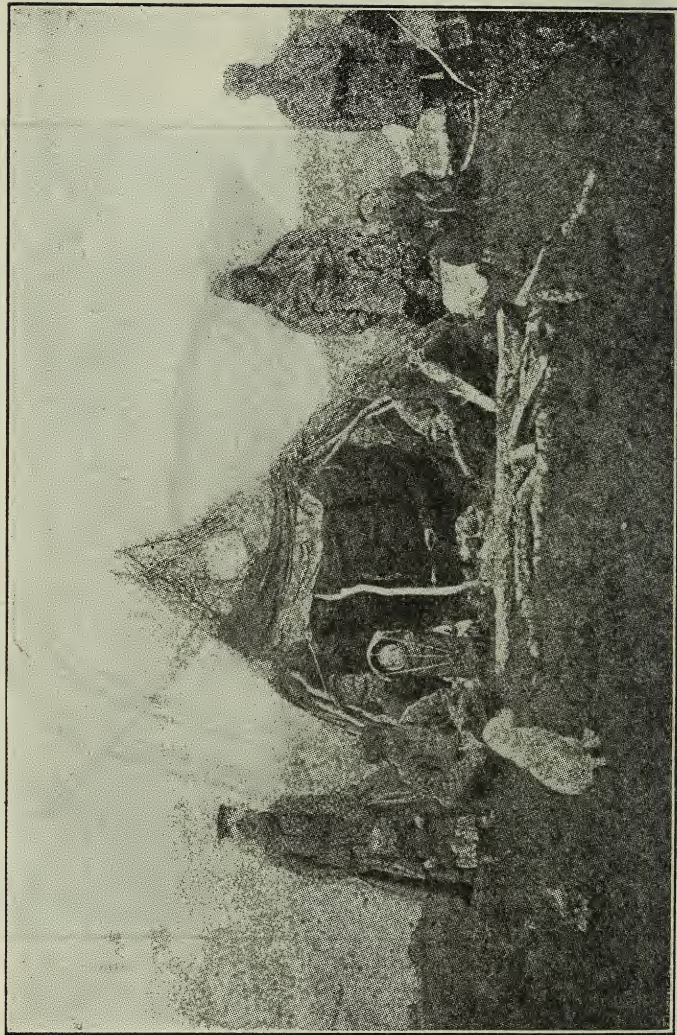


No. 8.—Harbor of Gaurilovo, showing type of Murman coast.

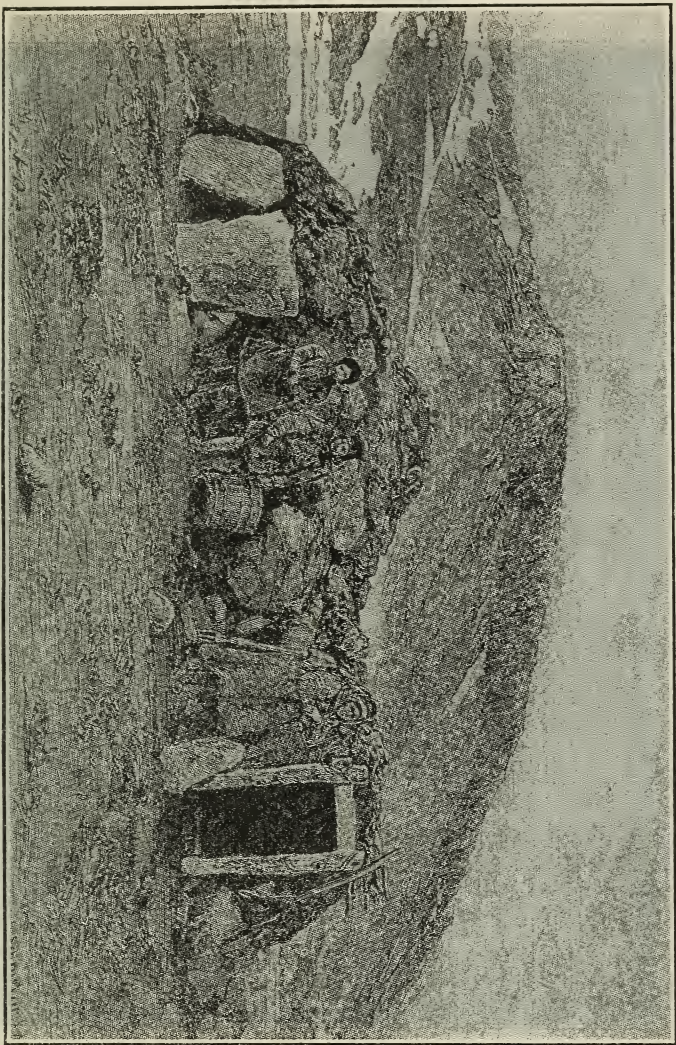
Russia. Route A.



No. 9.—A Lapp, showing winter costume and skis.

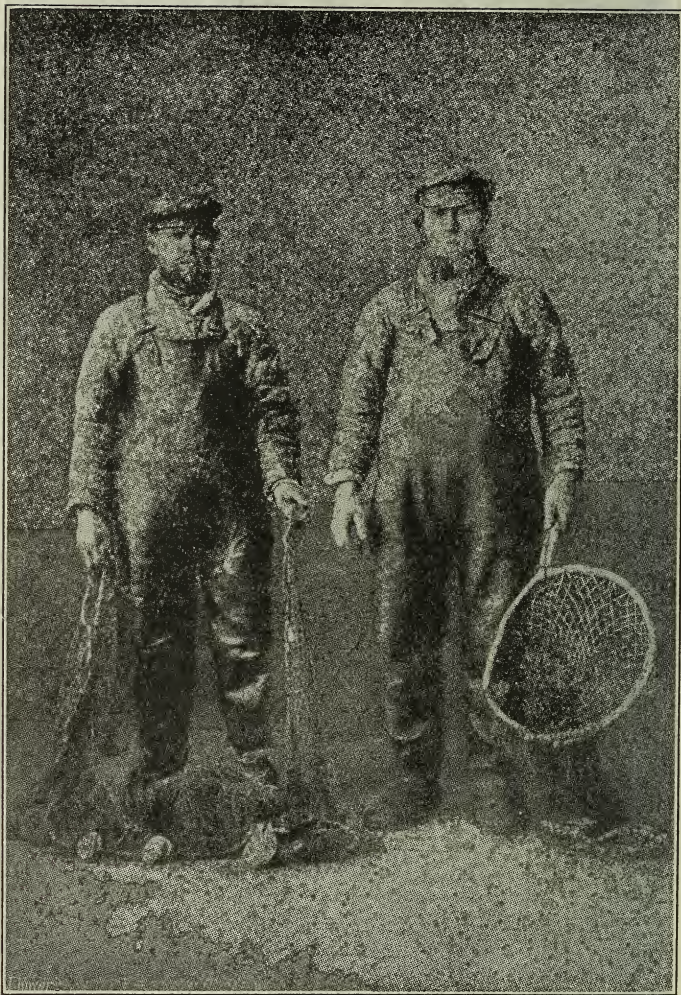


Russia. Route A.



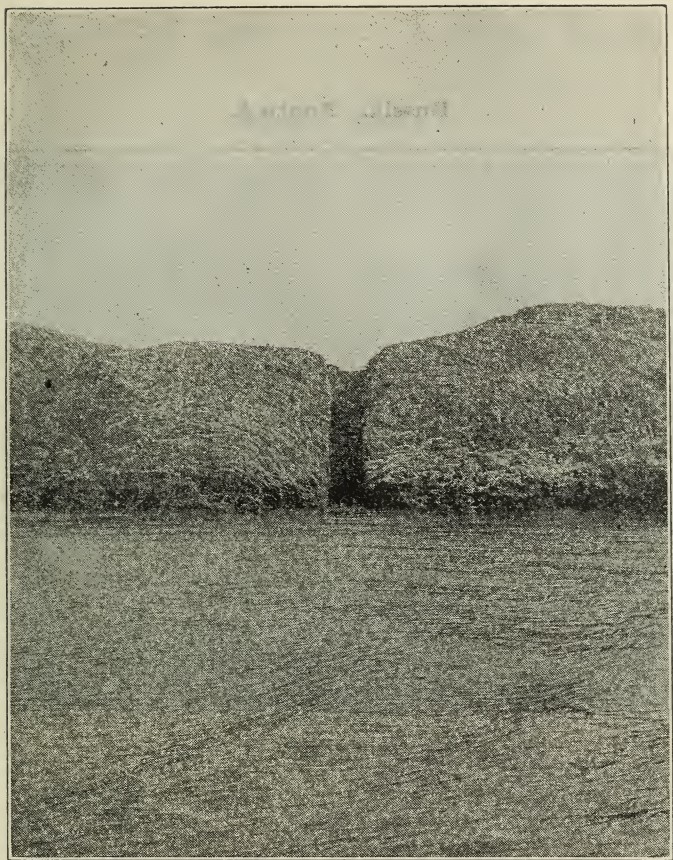
No. 11.—Winter home of a Lapp.

Russia. Route A.



No. 12.—Pomar types.

Russia. Route A.



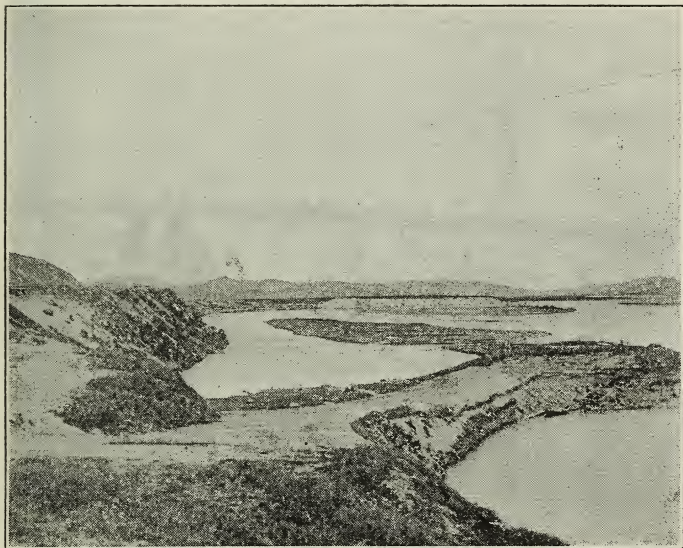
No. 13.—Scene on Murman coast, showing type of shore east of Pechenga Inlet.

Russia. Route A.



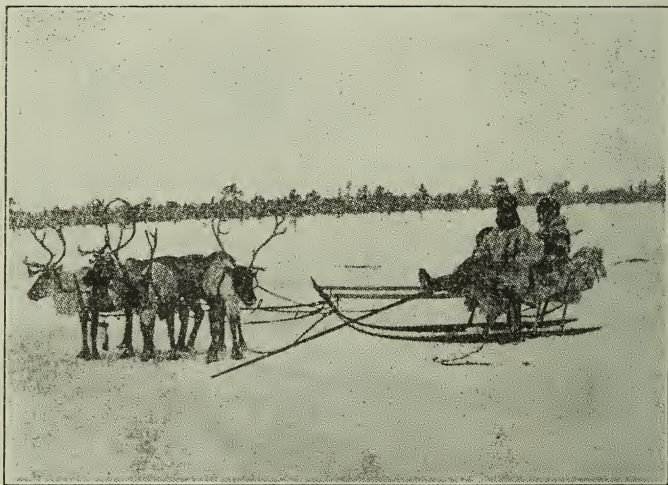
No. 14.—View on river south of Borisglob.

Russia. Route A.



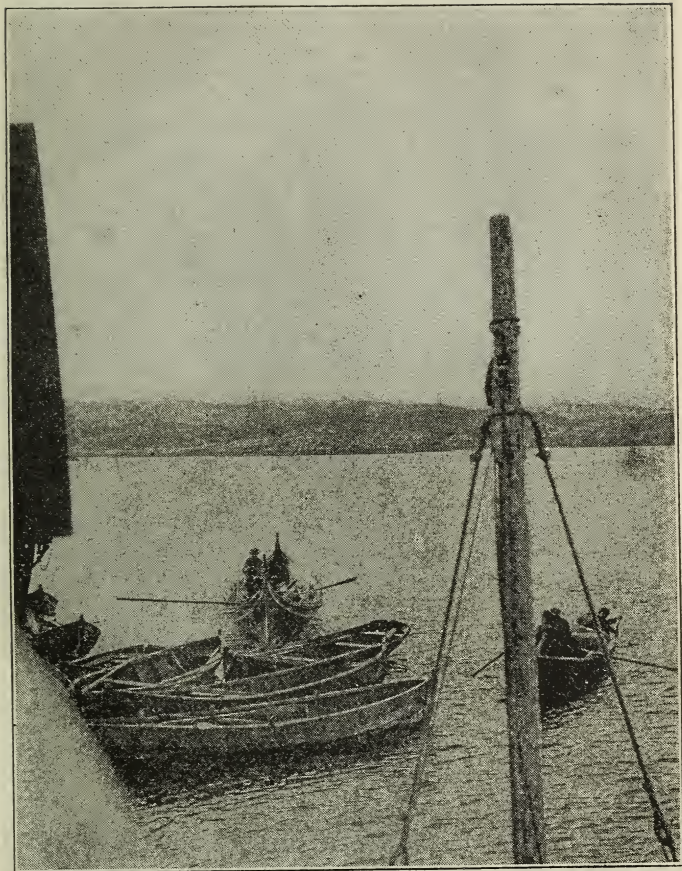
No. 15.—Pechenga Inlet.

Russia. Route A.



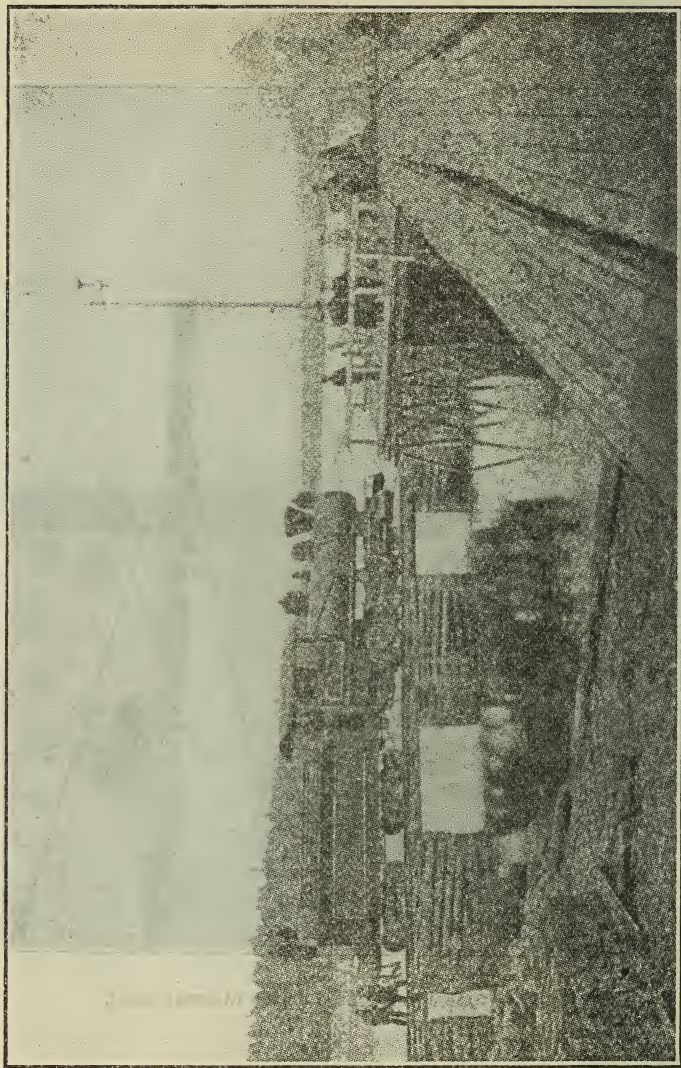
No. 16.—Reindeer and sledge. Showing type of transport. Another type of sledge with one deer is also used.

Russia. Route A.

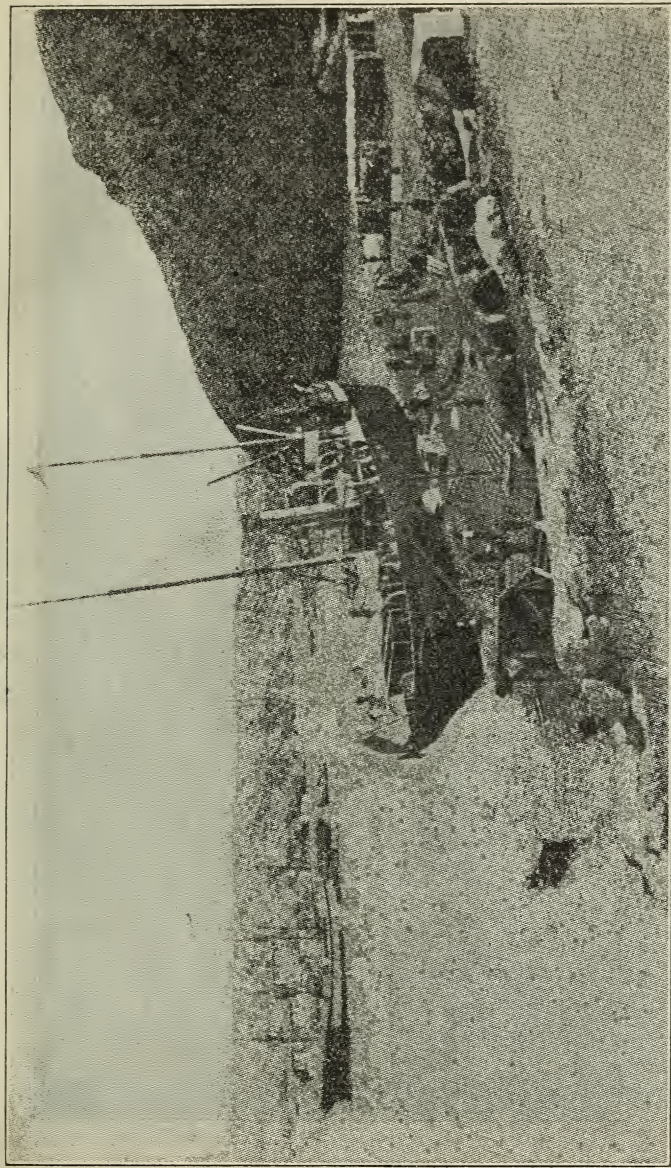


No. 17.—Type of boats used on the Murman coast.

Russia. Route A.

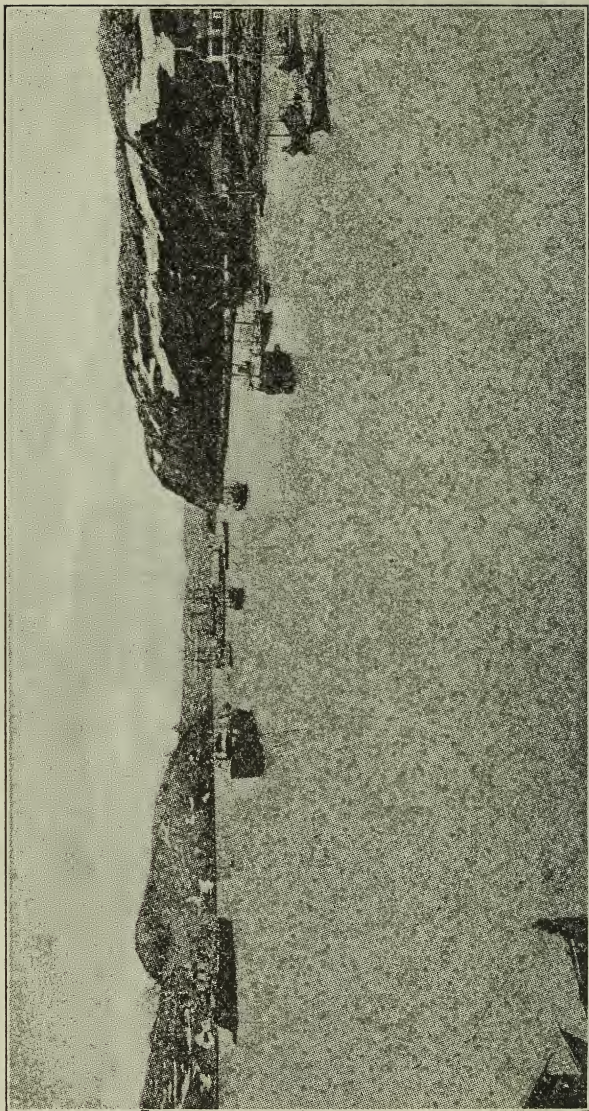


No. 18.—Type of locomotive in use.

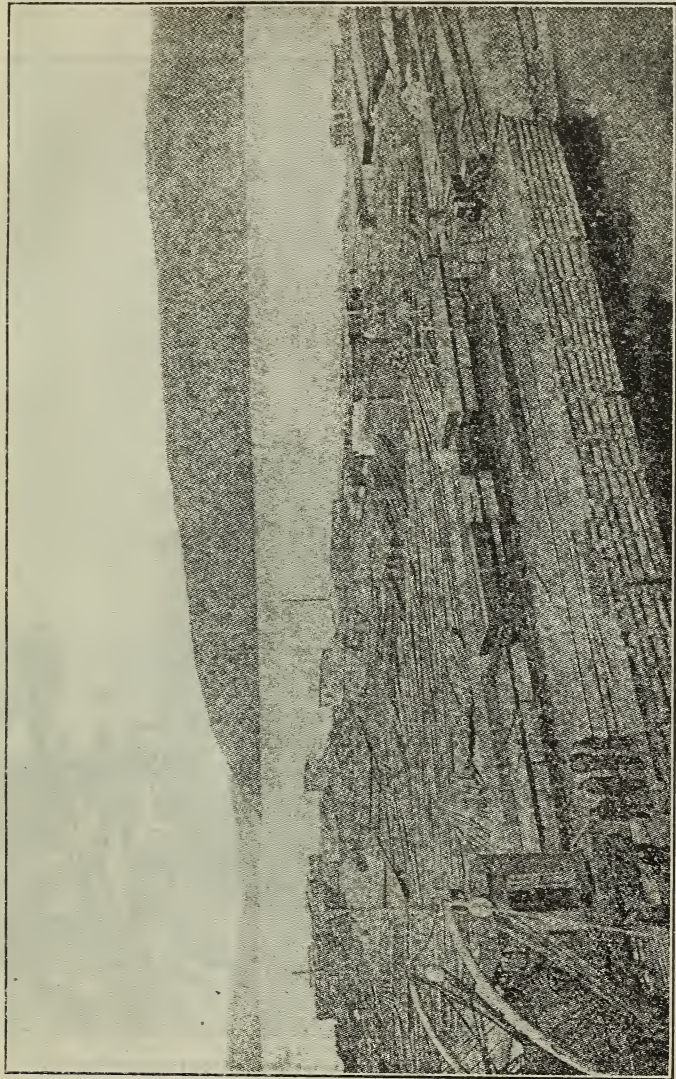


No. 19.—Pier at Alexandrovsk.

Russia. Route A.

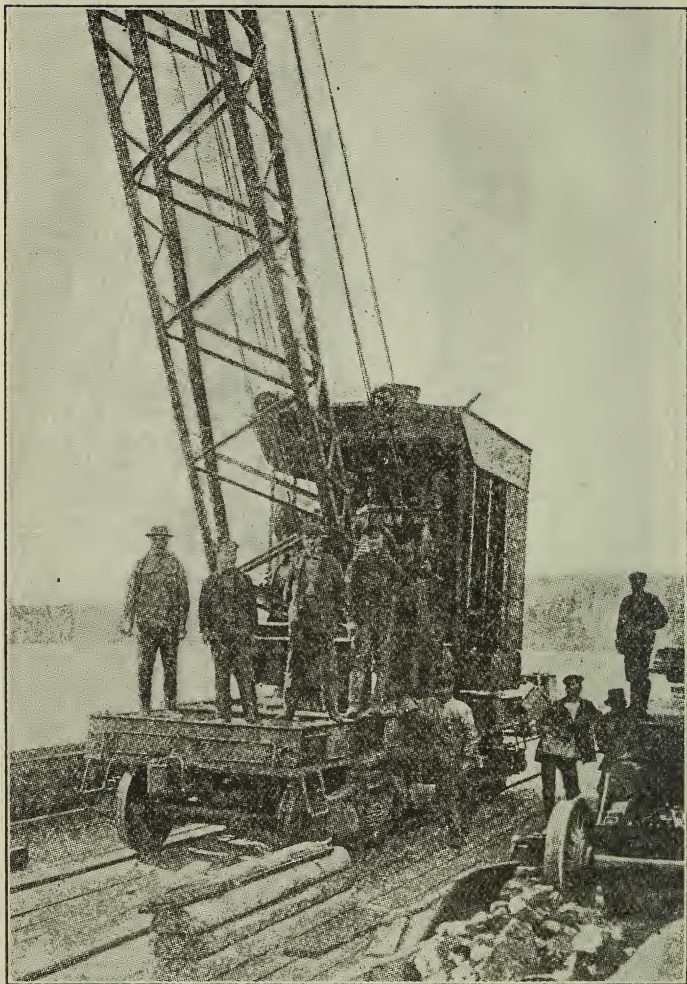


No. 20.—Yekaterina Harbor.



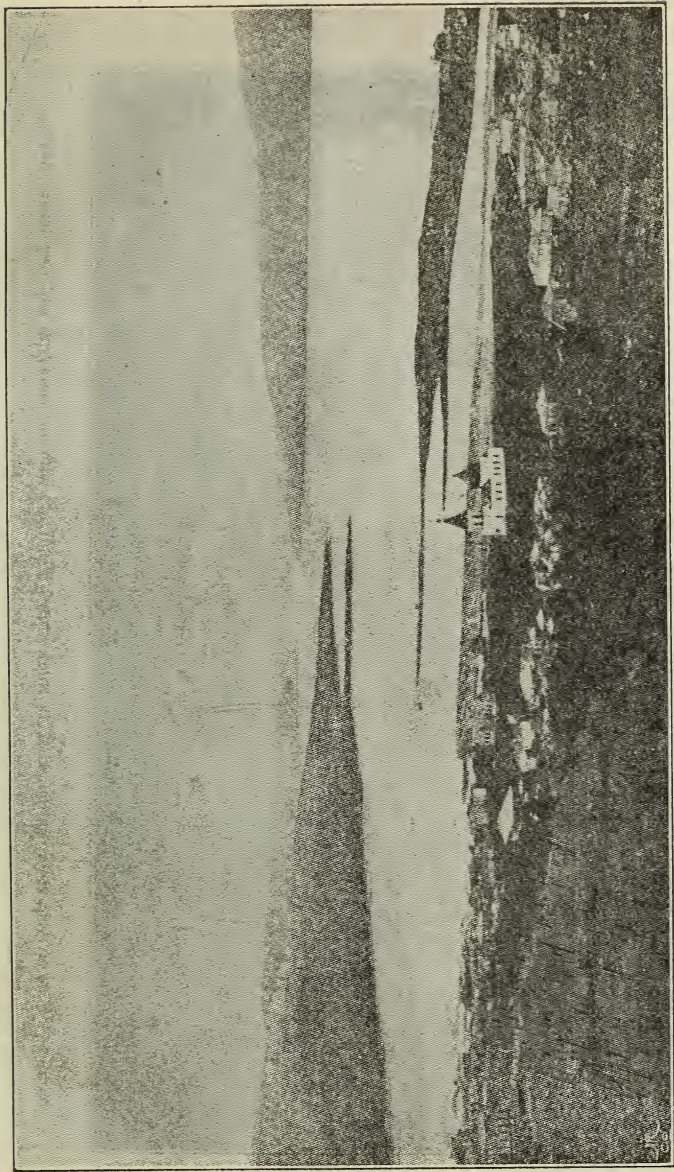
No. 21.—Docks at Murmansk.

Russia. Route A.



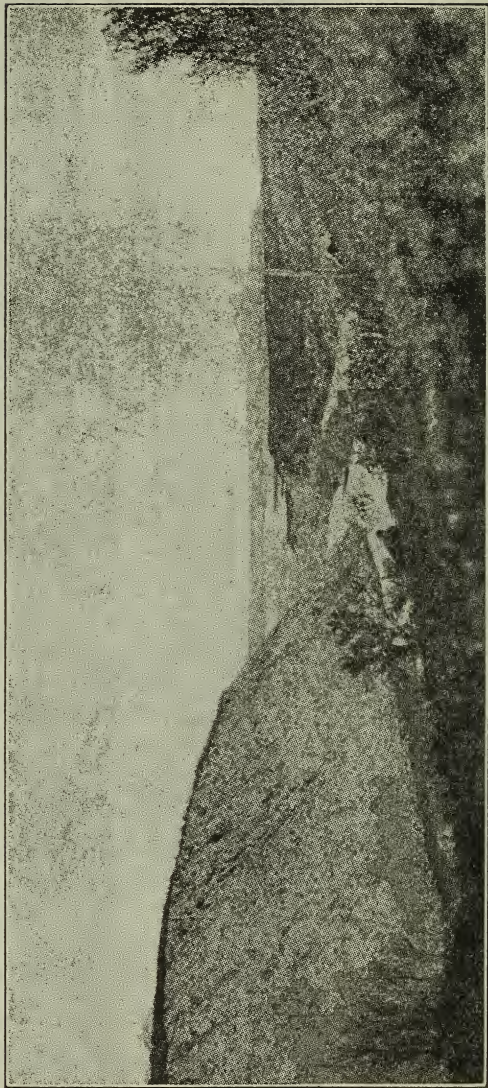
No. 22.—Traveling railroad crane (Brown type) at Murmansk.

Russia. Route A.

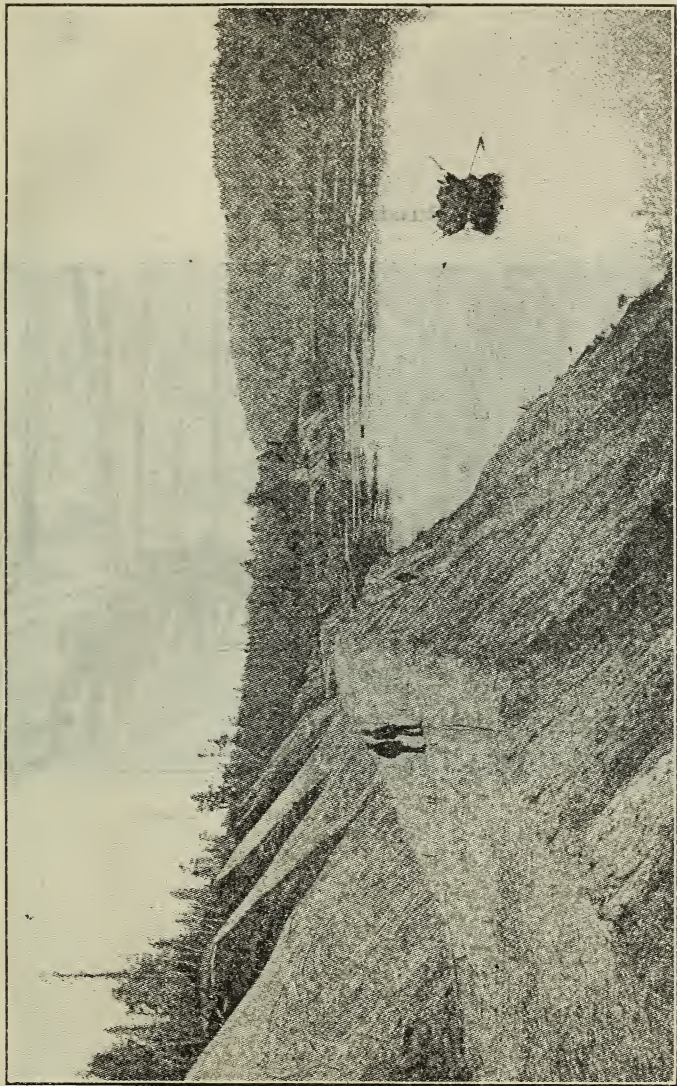


No. 23.—General view of Kola and surroundings.

Russia. Route A.



No. 24.—View of Kola River valley, at Kola Inlet, showing narrow winding valley up which railroad passes.



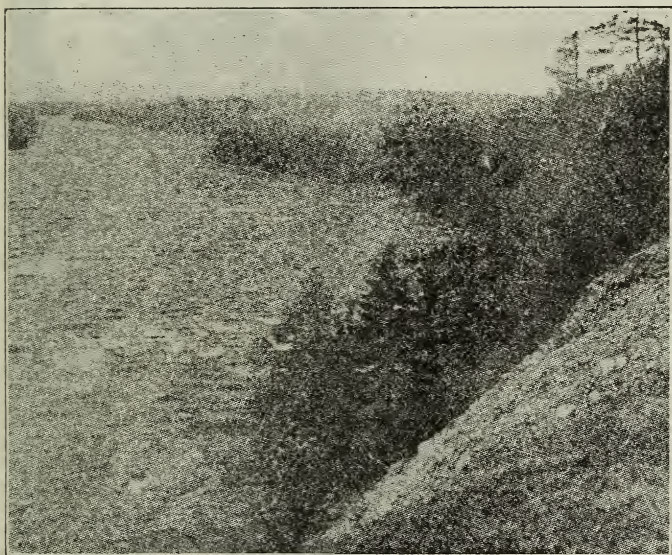
No. 25.—Railroad embankment along the Kola River, showing heavy cutting necessary.

Russia. Route A.

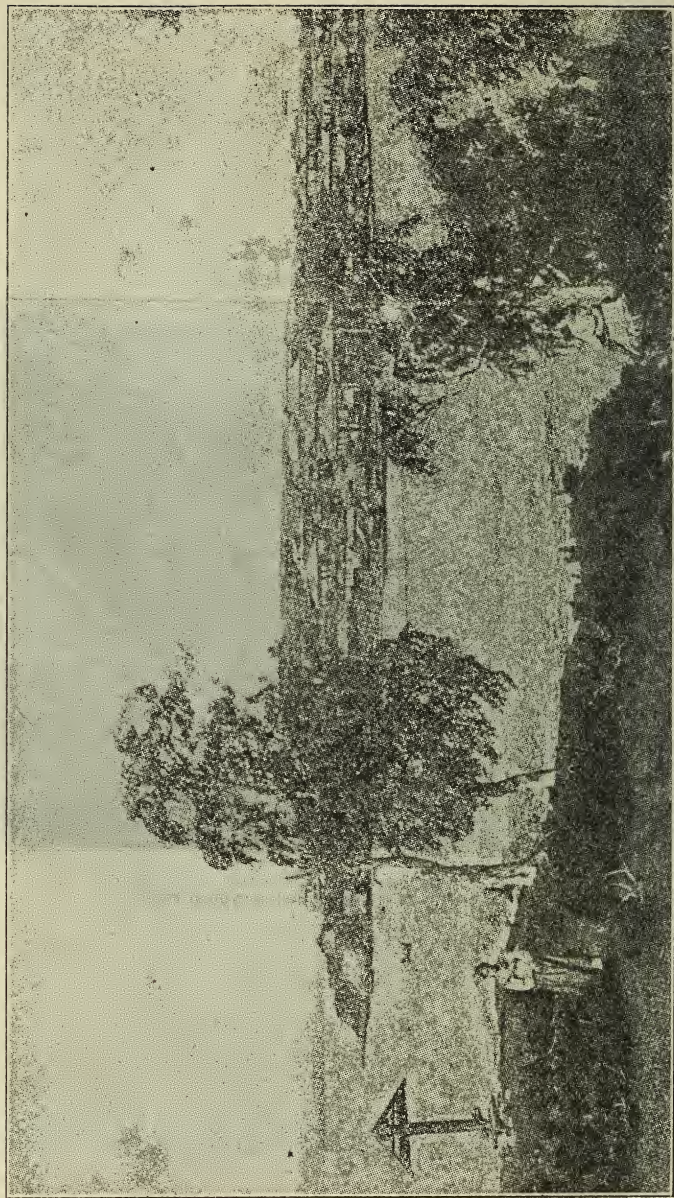


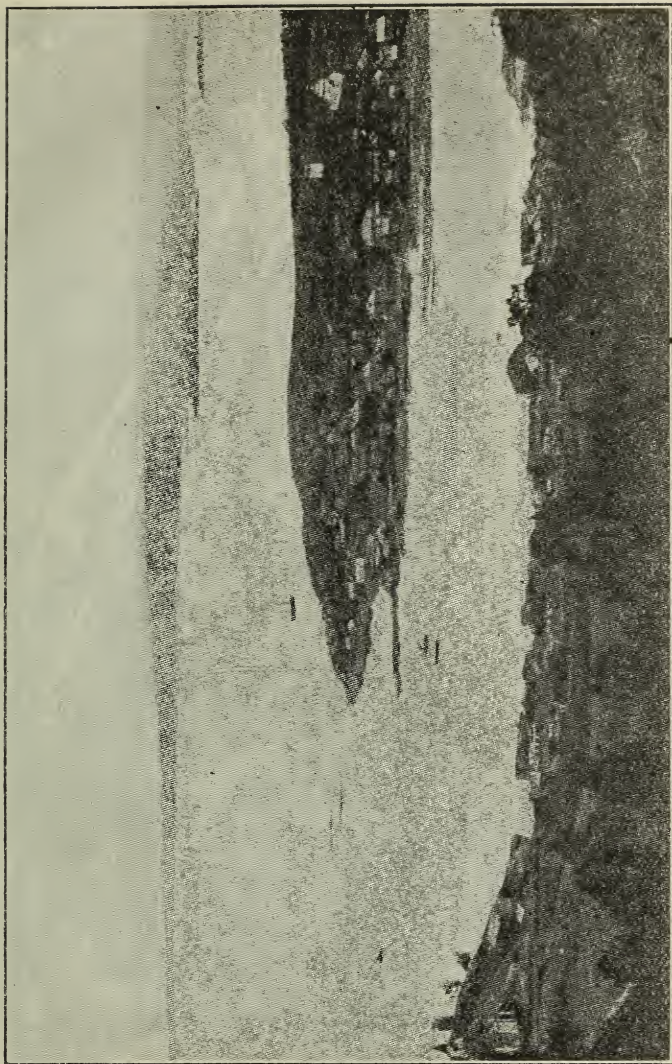
No. 26.—View showing forest near Pulozero.

Russia. Route A.

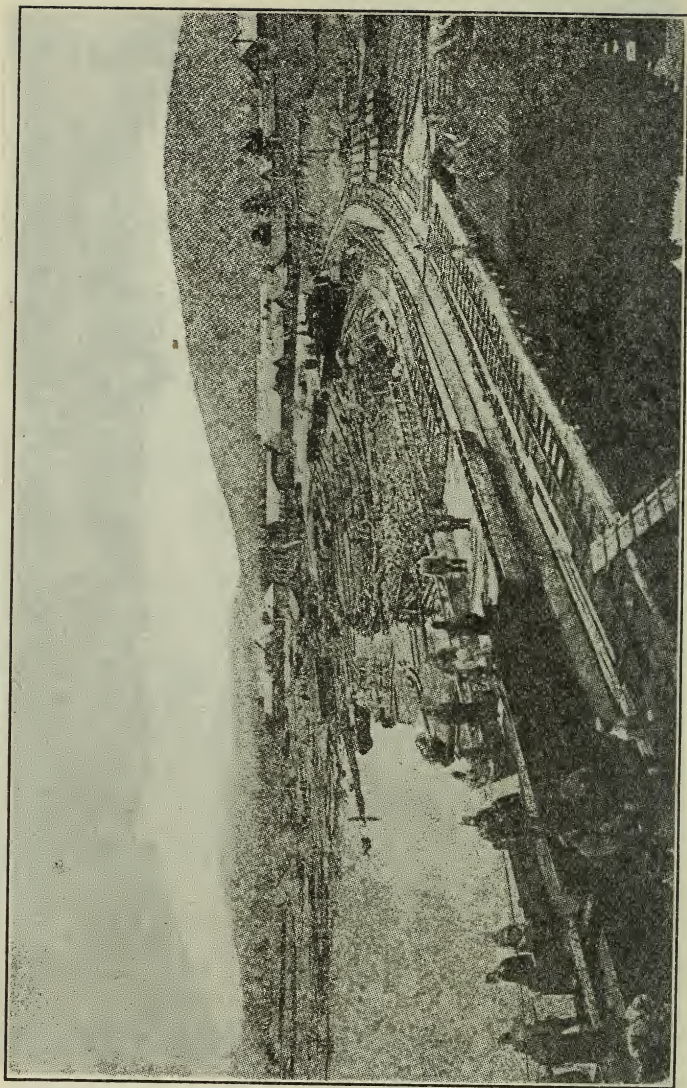


No. 27.—Niva River, showing typical rapids.

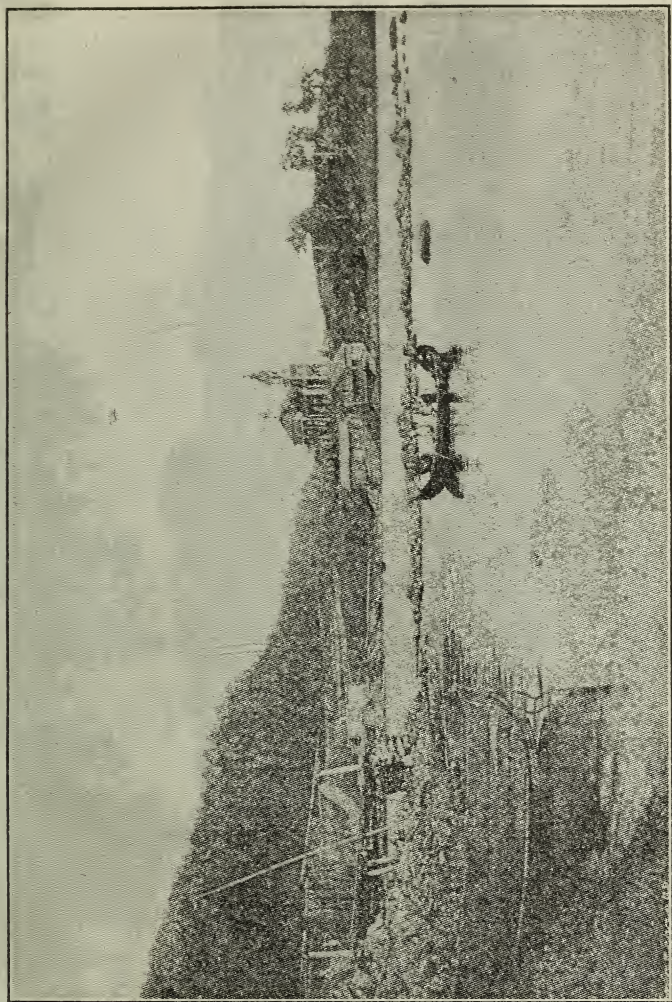




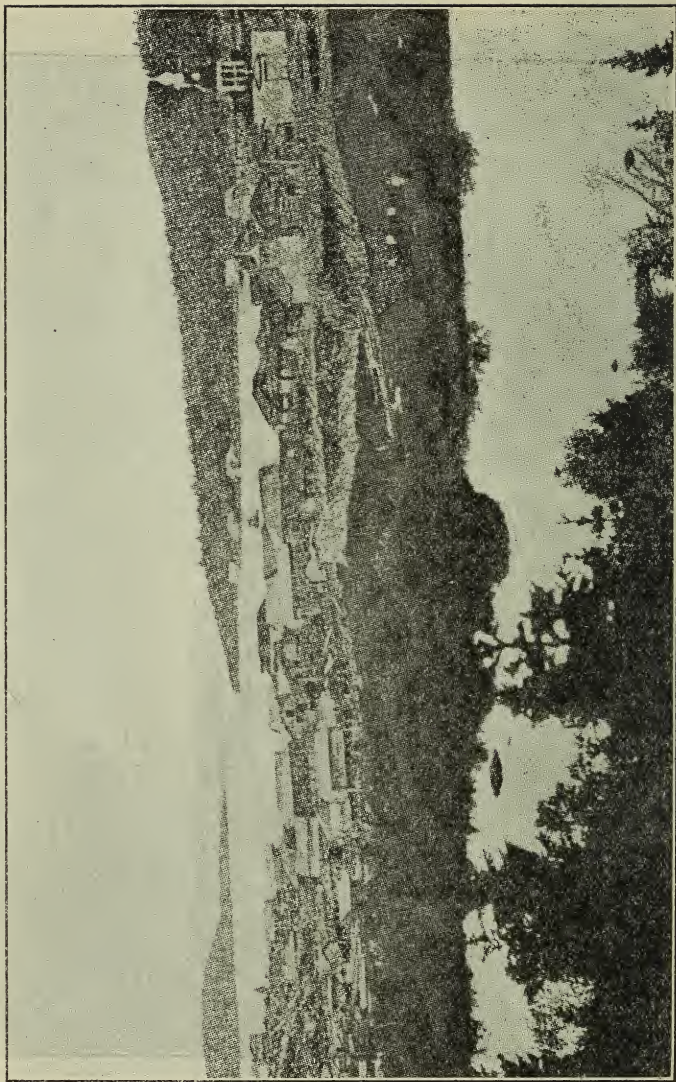
Russia. Route A.



No. 30.—Kandalaksha pier while under construction.

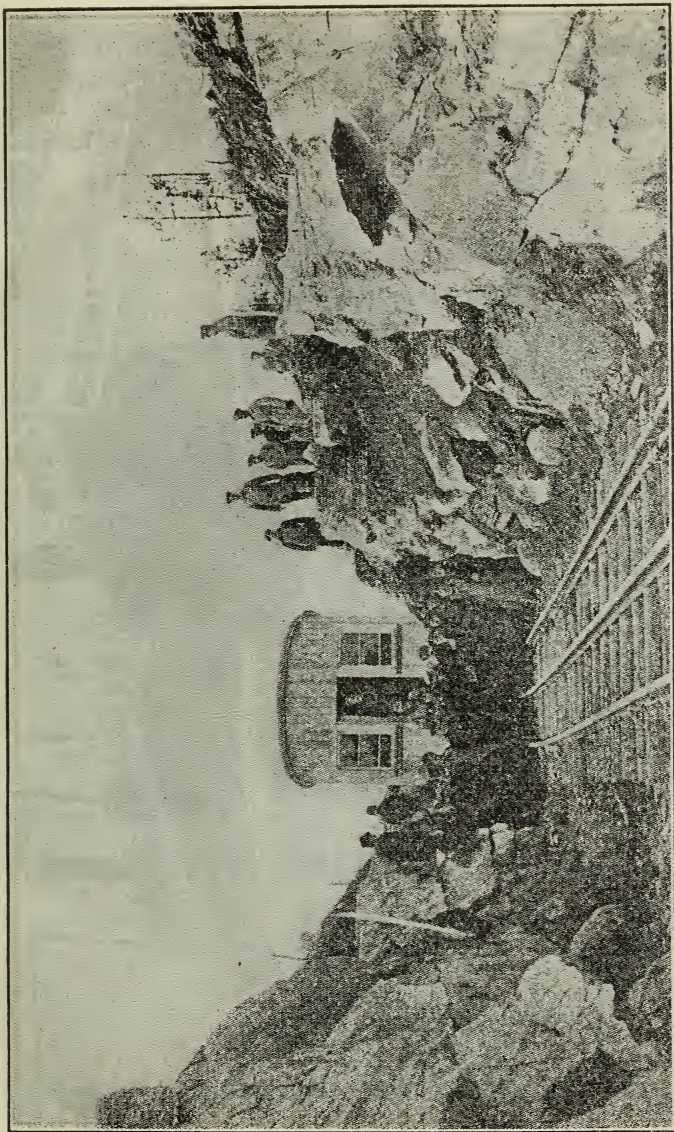


No. 31.—Kandalaksha, showing rapid rise of hills behind town and church.

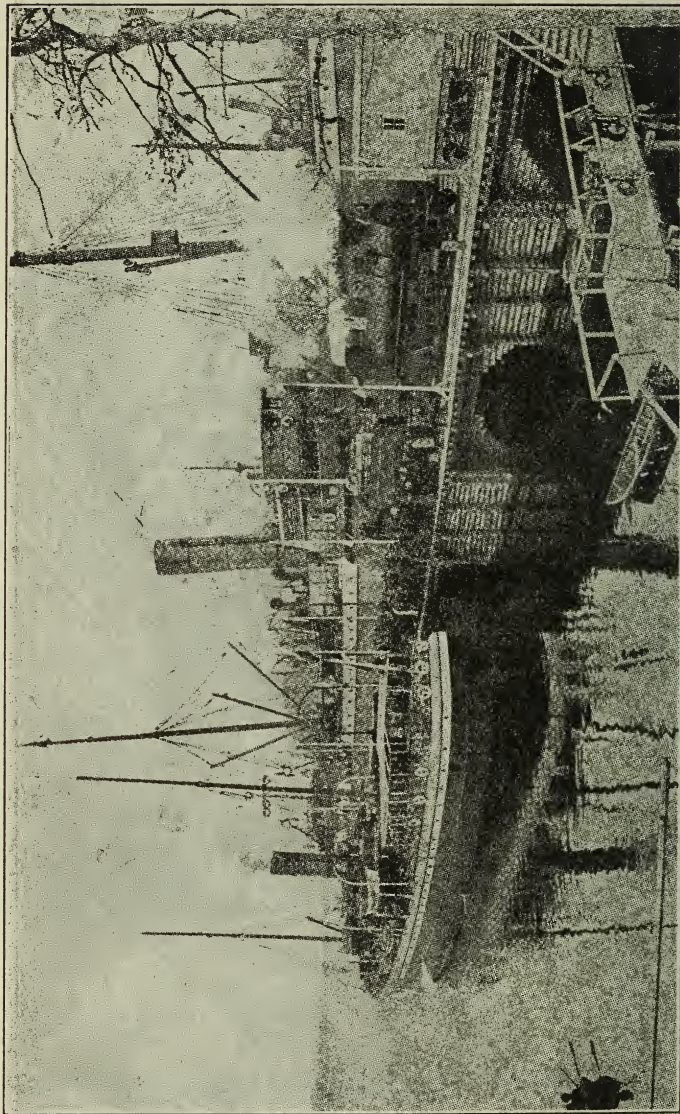


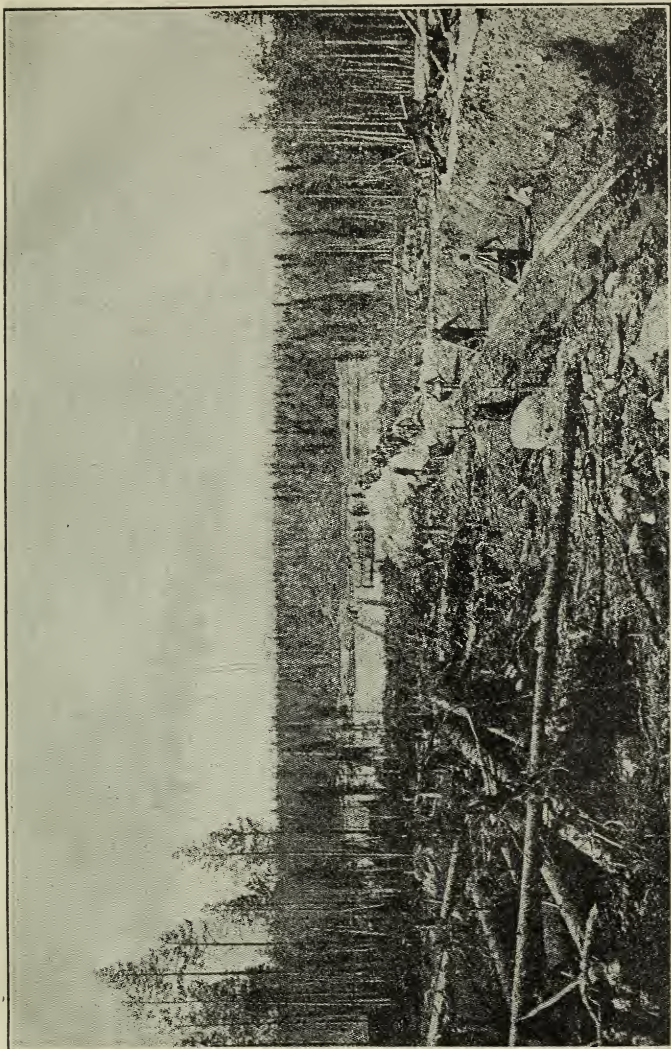
No. 32.—Village of Knyazhaya Guba, showing location and landmarks.

Russia. Route A.



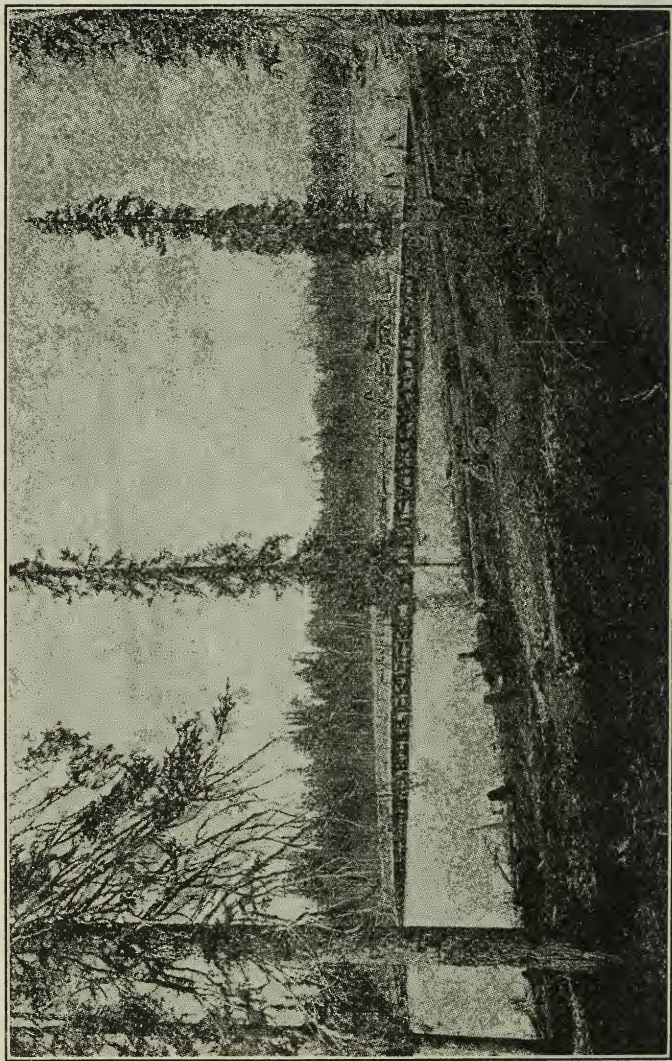
No. 33.—Rock cut near Chupa.



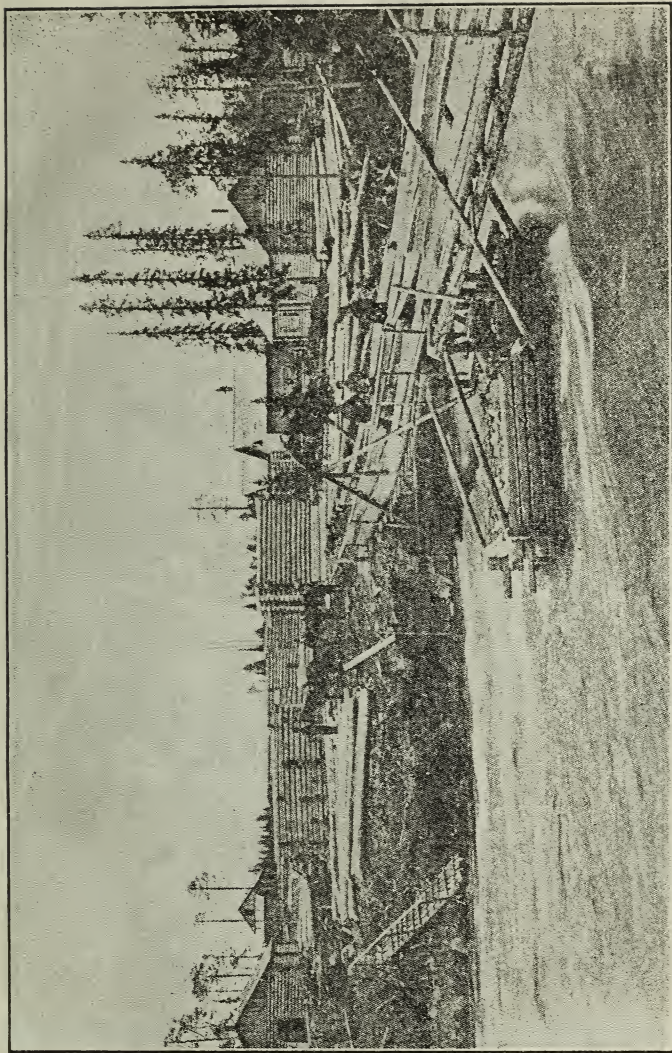


No. 35.—Filling in at bridge over River Keret. Much work of this kind is found along the line.

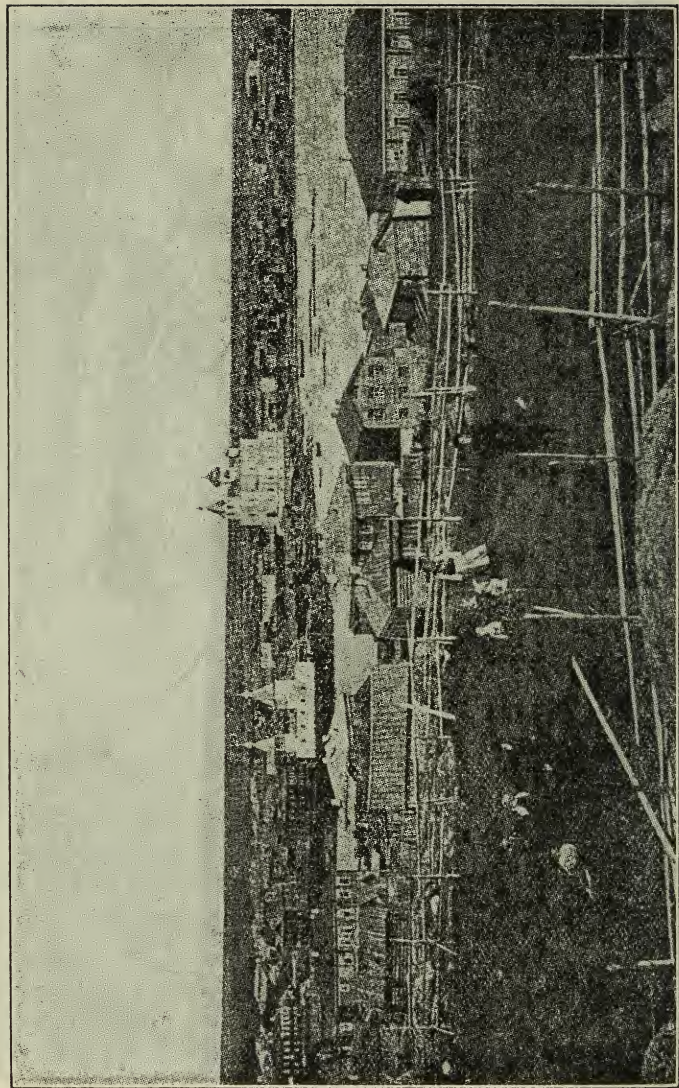
Russia. Route A.



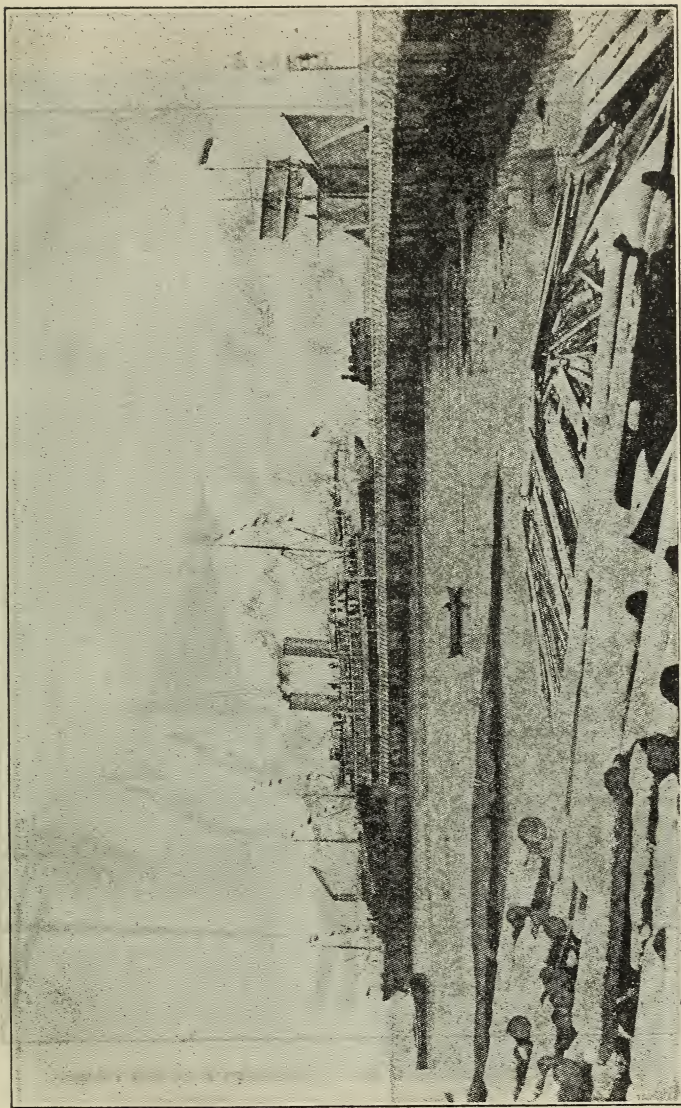
No. 36.—Bridge over River Keret, 210 feet long.



Russia. Route A.

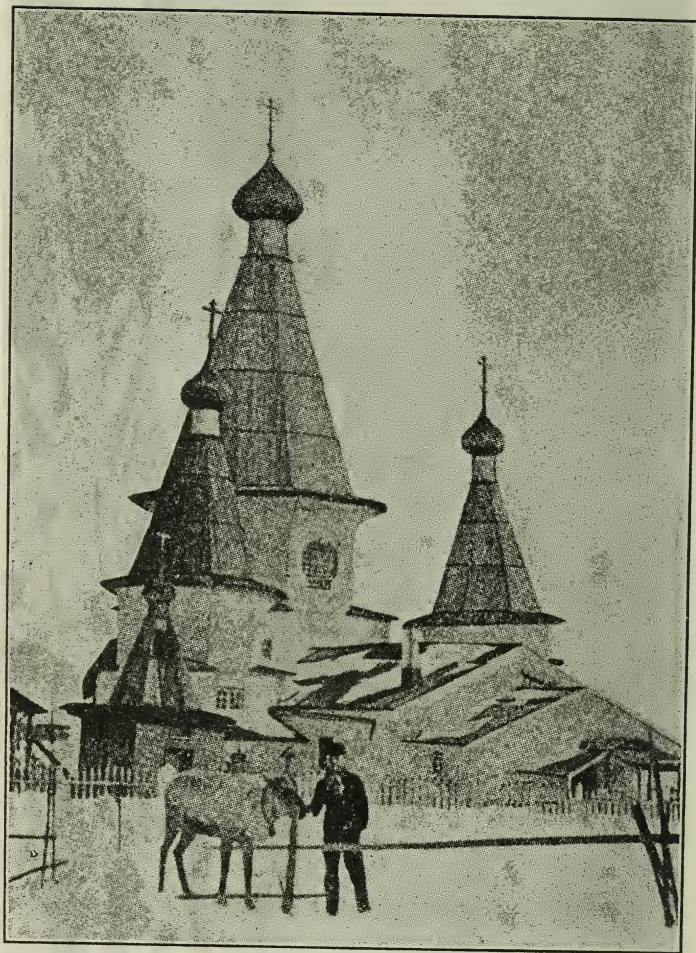


No. 38.—Kem, showing location of town and churches as landmarks.

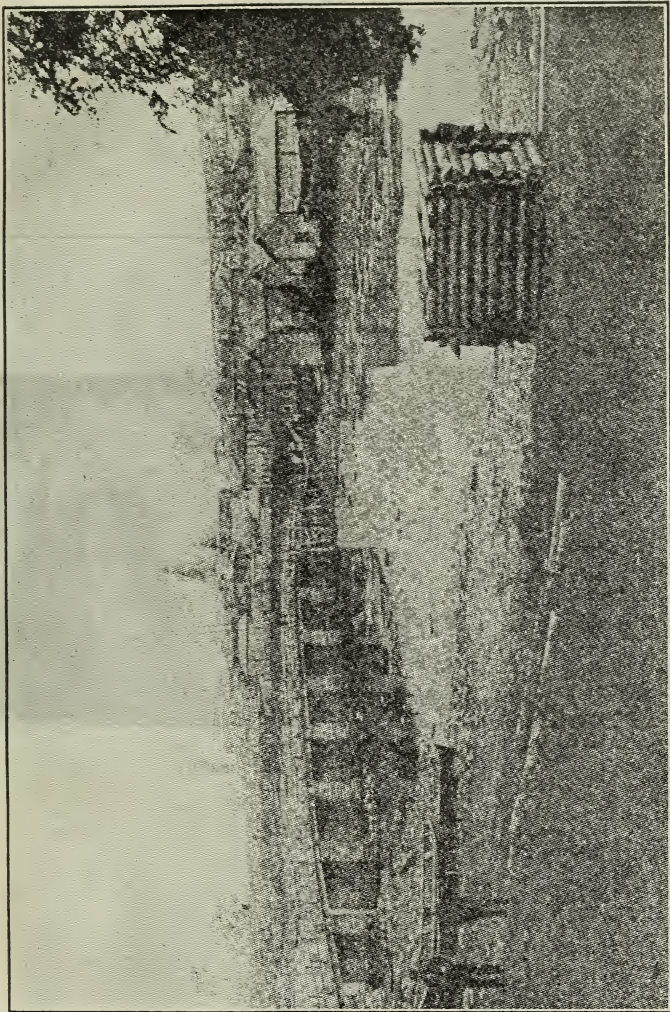


No. 39.—Railroad pier at Kem.

Russia. Route A.



No. 40.—Old cathedral at Kem. A landmark for this village.

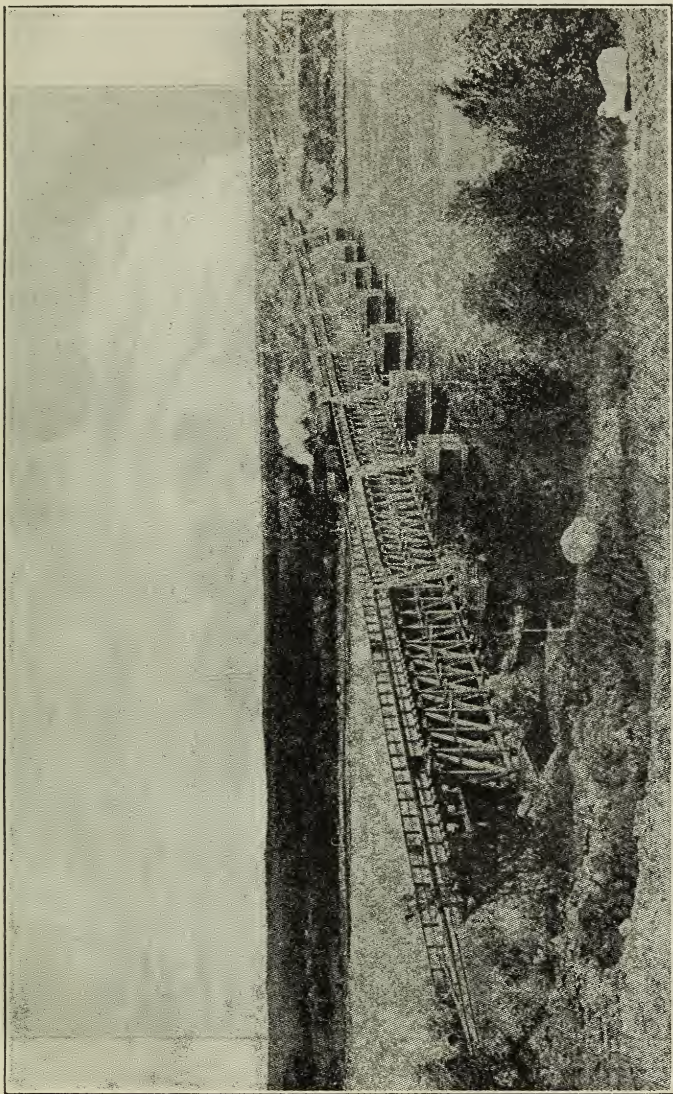


Russia. Route A.



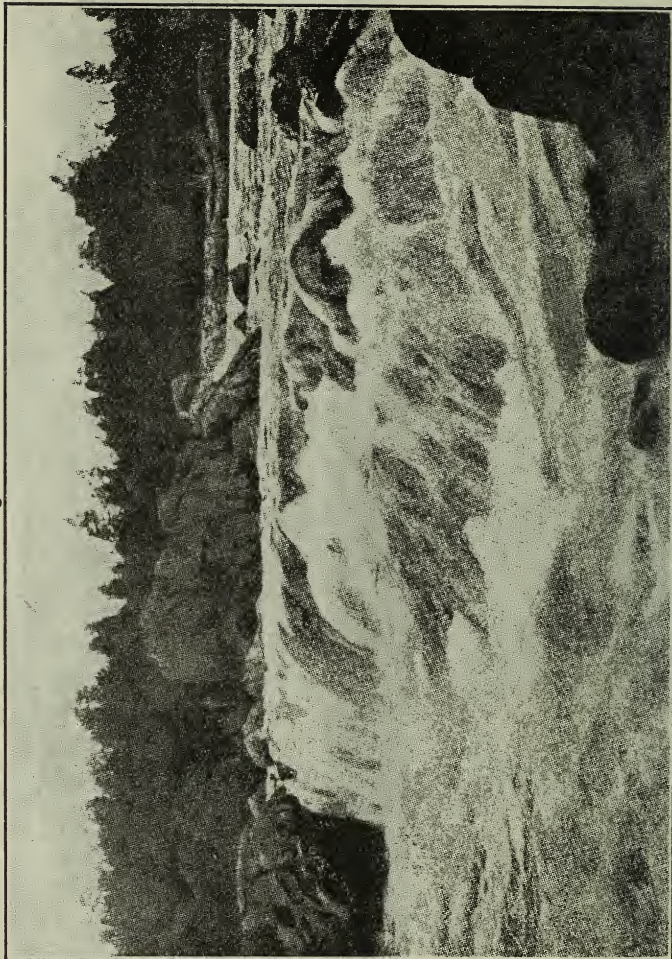
No. 42.—Solovetsky Monastery.

Russia. Route A.

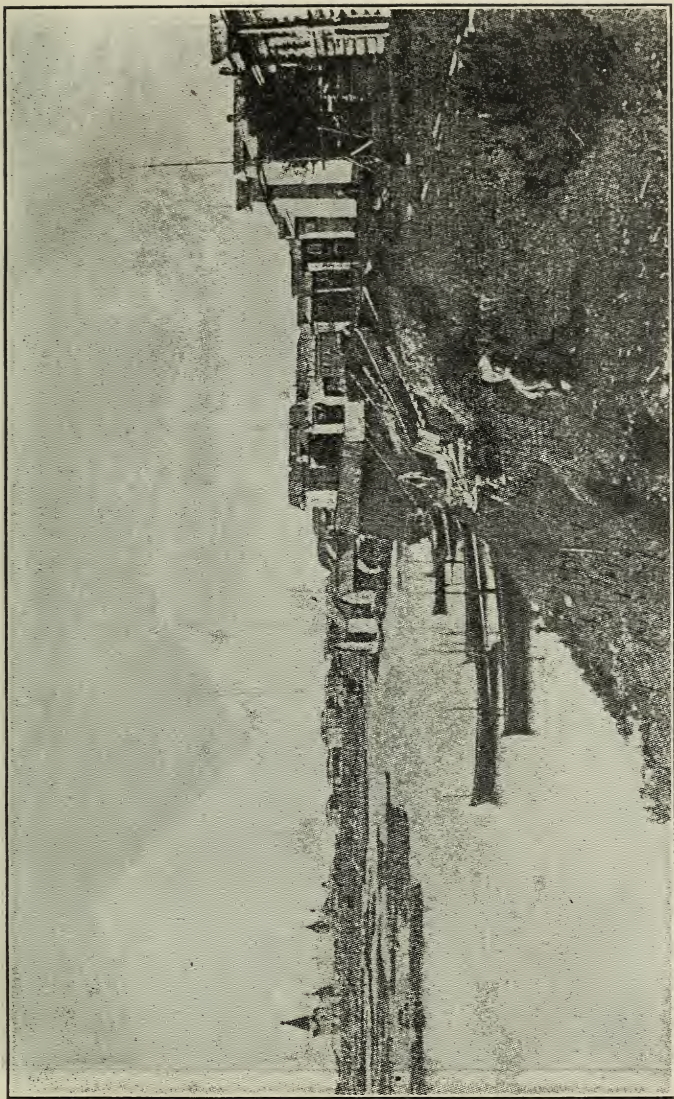


No. 43.—Bridge over River Kem, showing type of construction.

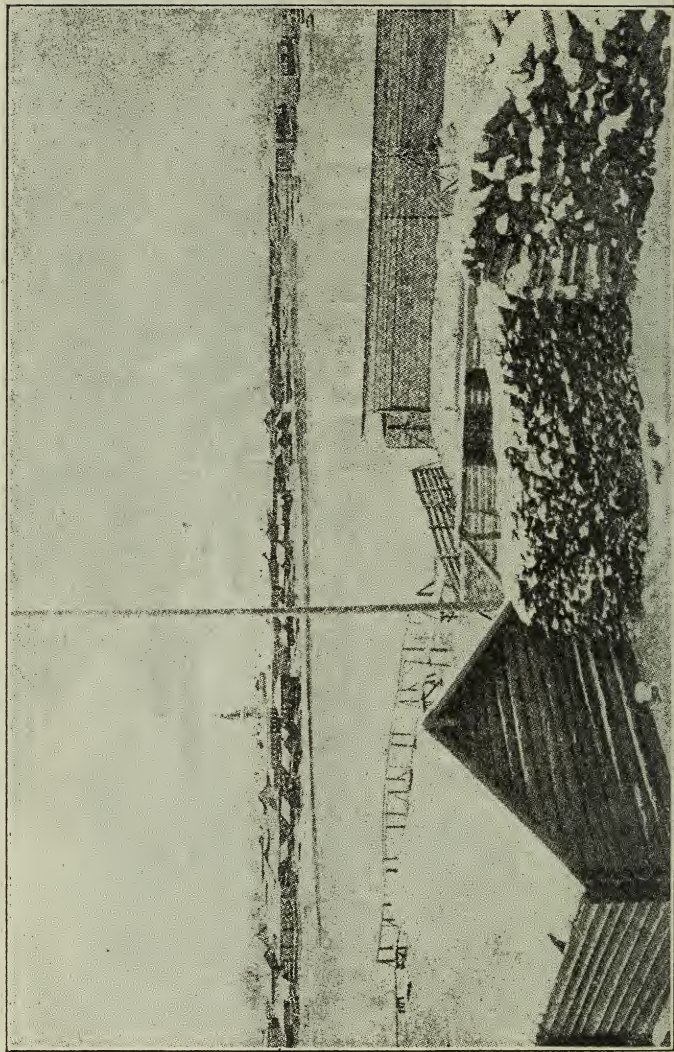
Russia. Route A.



No. 44.—Poduzhem Cataract on Kem River. Navigation on the rivers of this district is rendered impractical for long distances on account of the frequency of such cataracts and rapids.

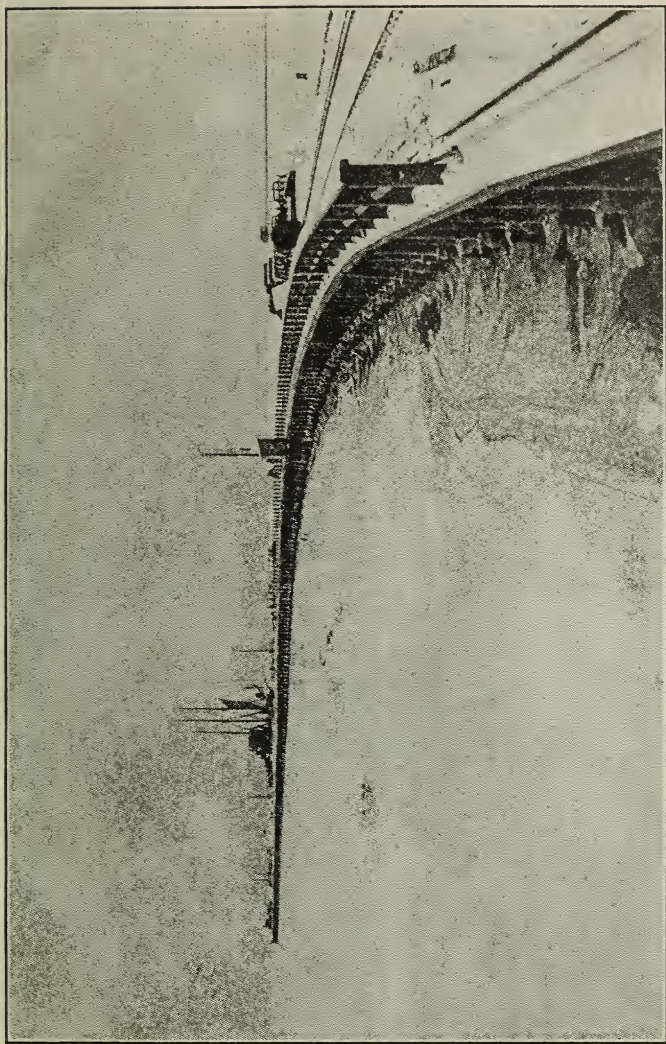


Russia. Route A.

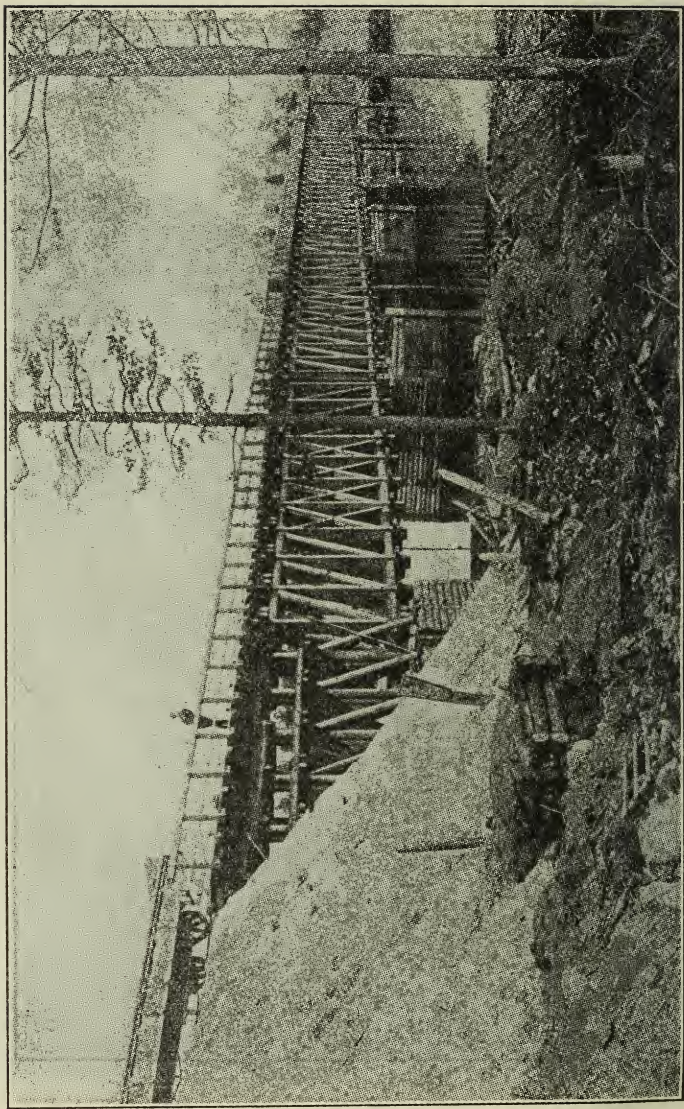


No. 46.—General view, Soroka.

Russia. Route A.

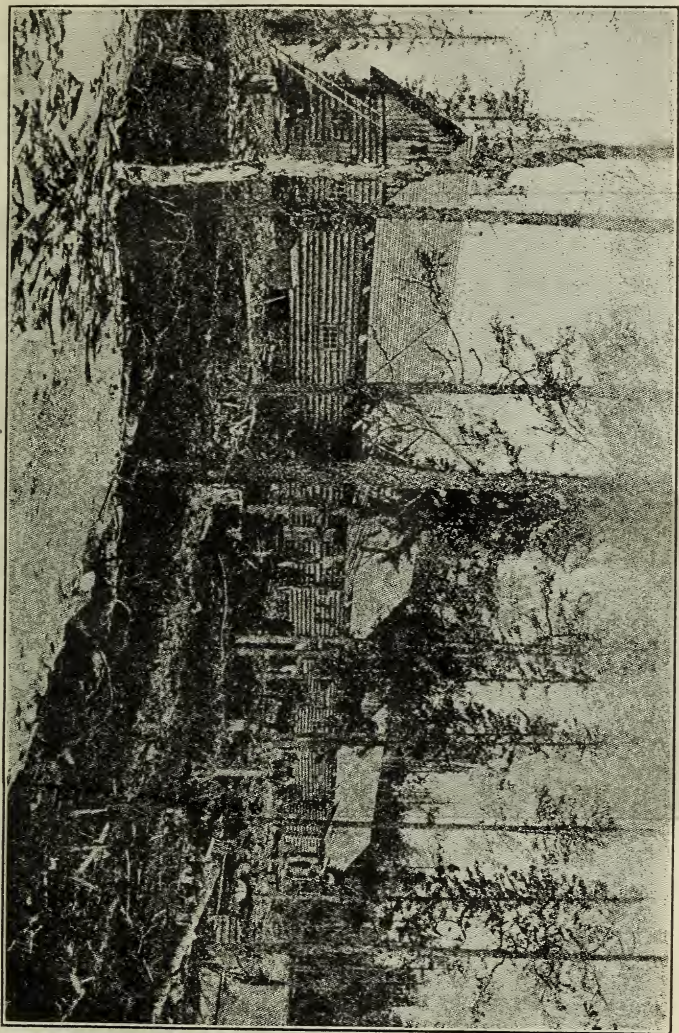


No. 47.—Pier at Soroka.



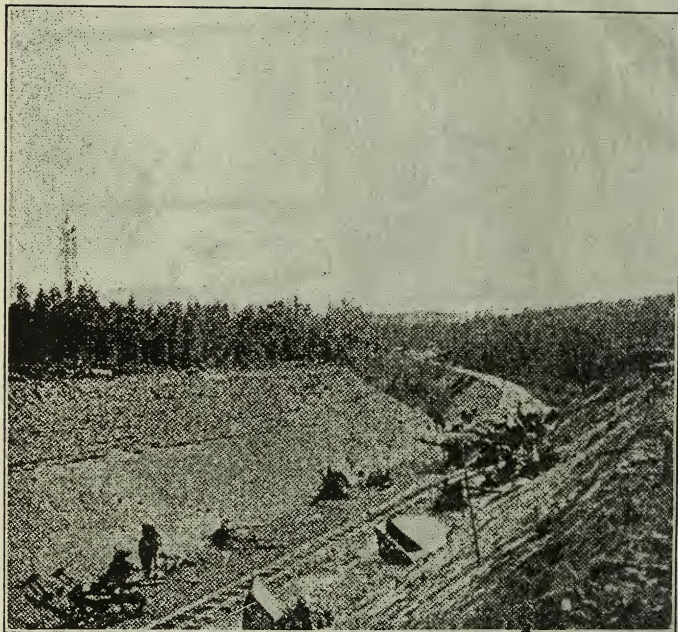
No. 48.—Bridge over Onda River, showing type of construction.

Russia. Route A.

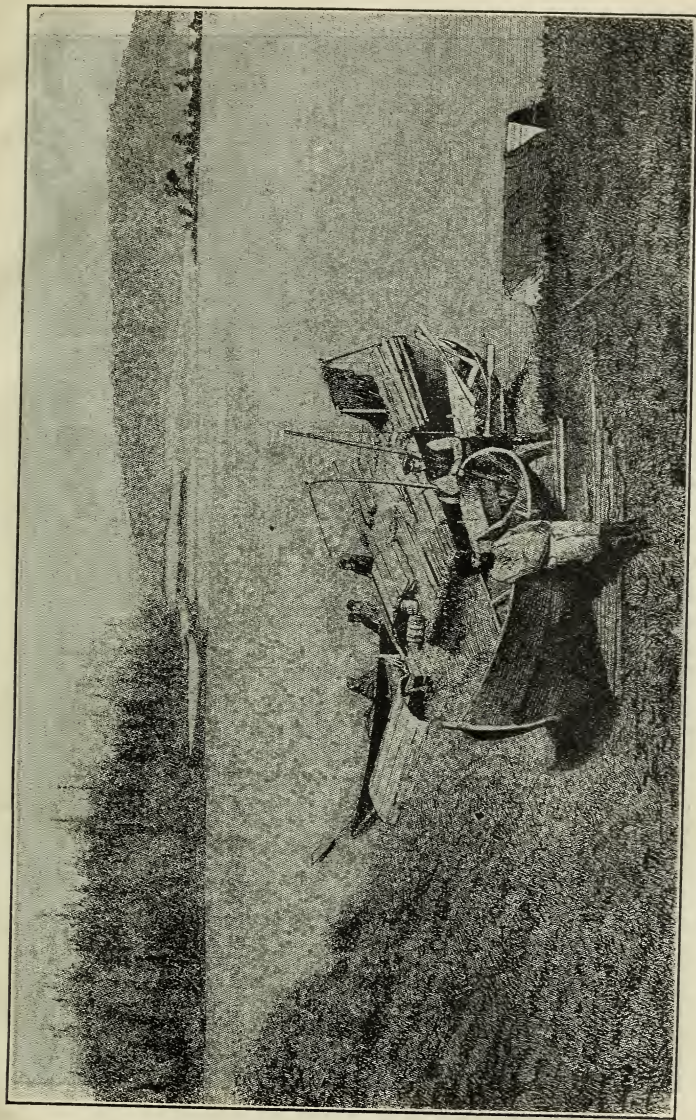


No. 49.—Type of workmen's barracks.

Russia. Route A.

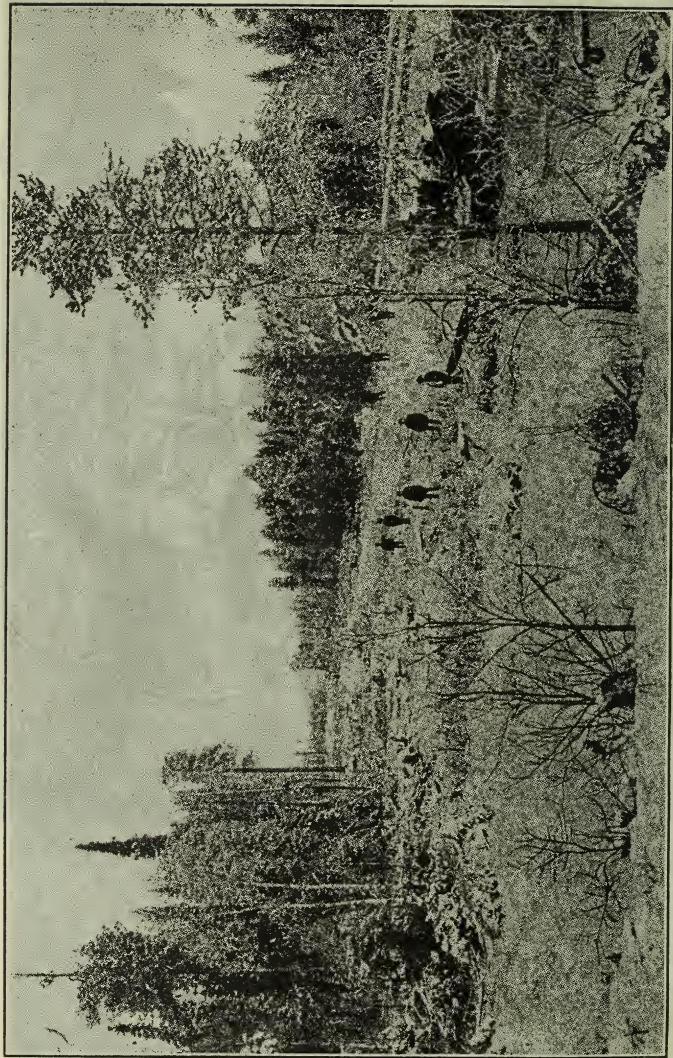


No. 50.—Cut at Kumsa River.

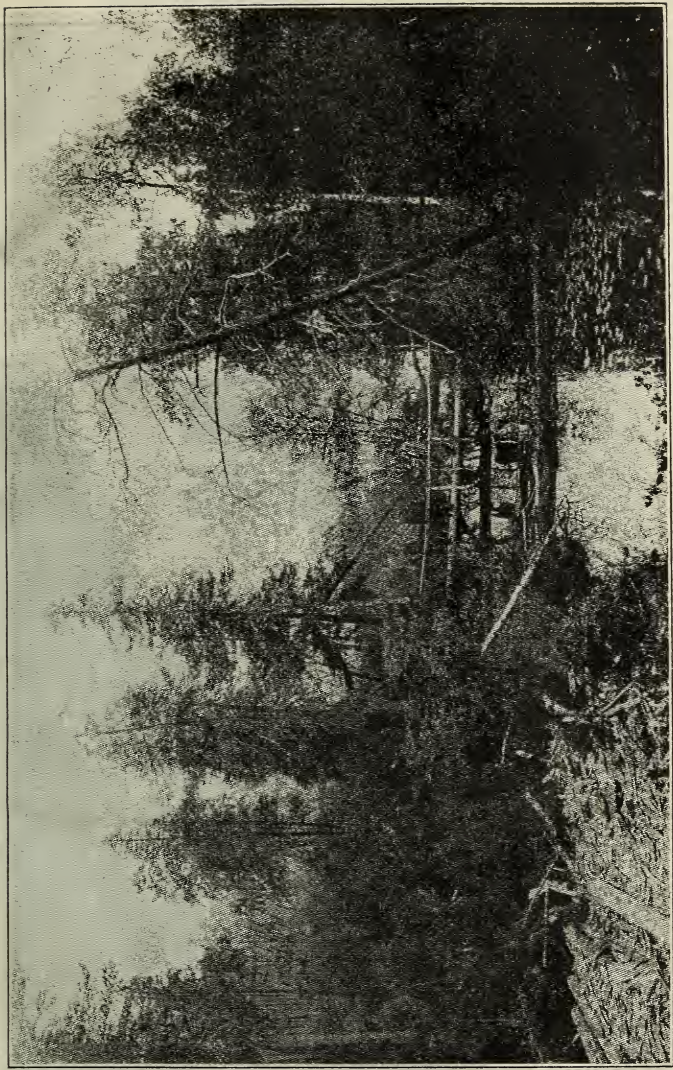


No. 51.—Typical boat on Lake Imandra.

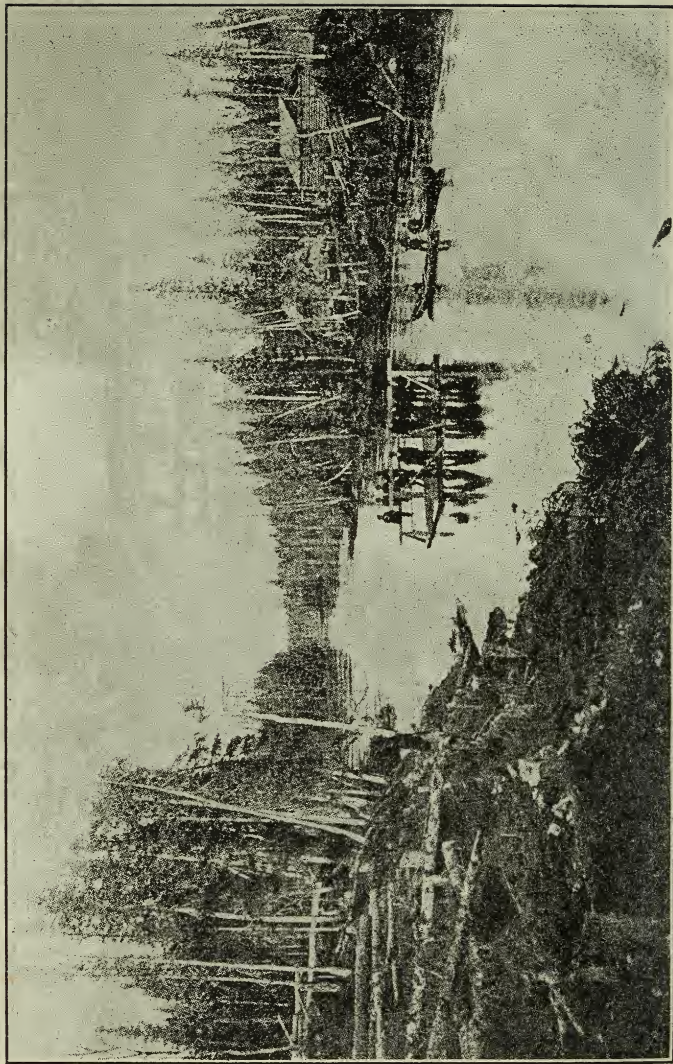
Russia. Route A.

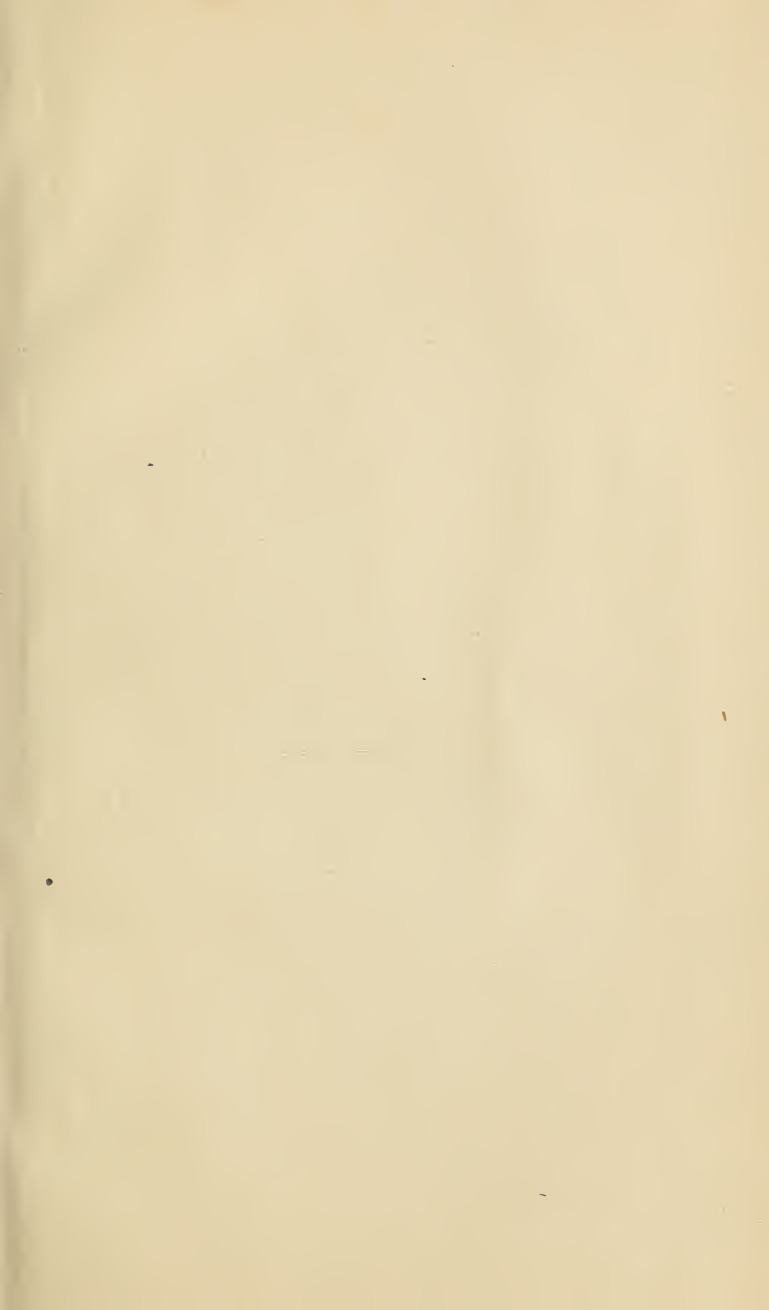


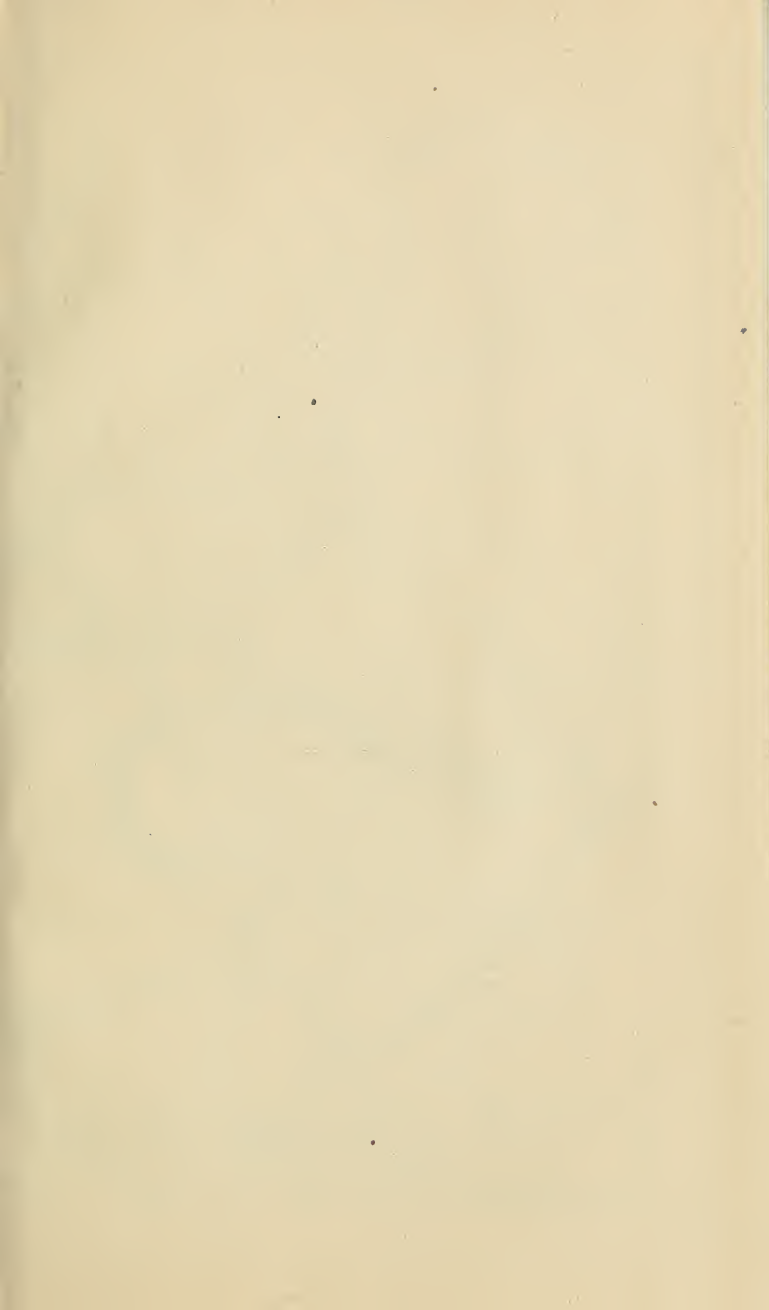
No. 52.—Typical view on the Murmansk line.

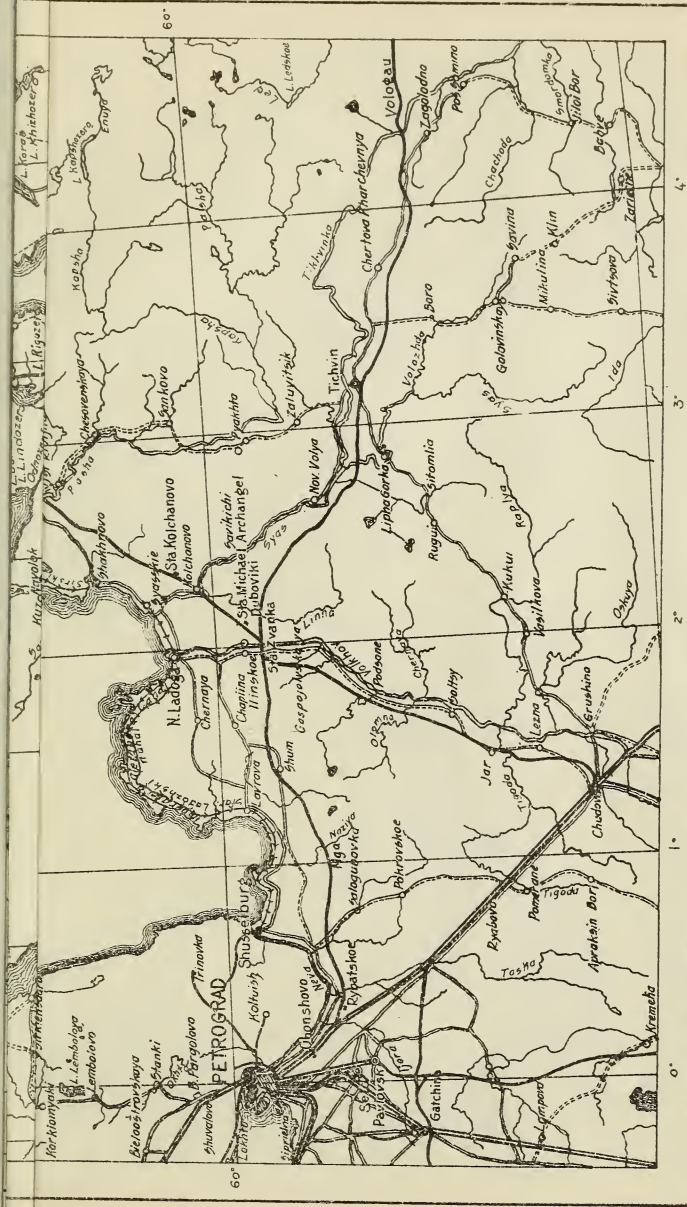


No. 53.—Typical native bridge.









To accompany MILITARY MONOGRAPH on "MURMAN RX and KOLA PENINSULA"
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MURMANSK-PETROGRAD RAILWAY AND ADJOINING REGION

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